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A  
LETTER

FROM

*Dr. James Walkinshaw*

TO

*Sir Robert Sibbald.*



LONDON,

Printed in the Year 1709.





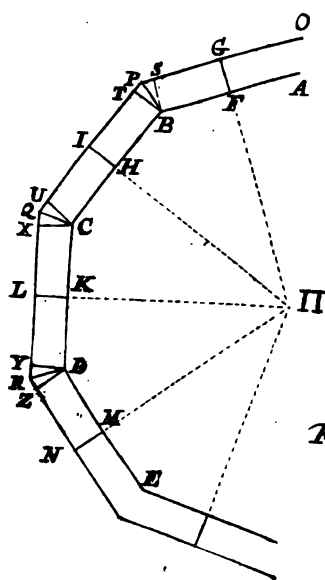


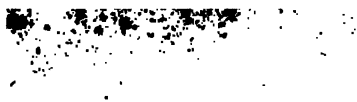
Fig. 1.

Fig. 2



Fig. 3





S I R,

**I** Have seen the Libel, rather than Letter, falsely written in your Name to Doctor *Pitcairn* : And I think you may save your self the Trouble of a Vindication. The Sham is too gross to take. None that knows Sir *Robert Sibbald*, can ever be induc'd to believe that such Ungentleman-like Language could have dropt from his Pen.

So Rude an Attack upon that Learn'd Gentleman, my worthy Friend, to whom I ow so many Obligations, you may be sure, could afford me no very agreeable Entertainment. 'Twas provoking to see one of Doctor *Pitcairn's* Merit, so scurvily us'd ; And without Indignation, one could not bear so foul Language thrown upon his Friend, almost in every Page. Had the Author but shew'd a little more Civility, he might have differ'd from the Doctor, as he pleas'd, and Wrote against him too, to the World's End for me ; Not should you have been troubled with Reading, more than I with Writing these hasty Reflexions which I send you, and which nothing but the Height of Incivility to my Friend could have drawn from me.

If I have happen'd to shew any thing of Keenness, you'll the more readily Excuse it, that

A

you

You know that it is far from my natural Way. Tho' the Occasion was Provoking, 'tis what I have endeavour'd to avoid; And if after all, something of this kind still appears, 'tis owing to nothing but the wretch'd Pattern that lyes before me while I'm writing. Some Things are of that pestiferous Nature, that they cannot be Touch'd without Infection, and bad Books are like bad Company, if we Study the one, or Frequent the other, insensibly we draw in the Poison, and some thing sticks to us in Despite of all the Caution we can use.

As to the Author, You'll perhaps be surpriz'd, when I tell you, we have a Gentleman in this City, who tho' he does not speak it out, yet all along has acted such a part in this Scene, as if he seem'd to court the Honour of the scoundrel Performance, and were pleas'd to be thought Author of it, without his saying it. Tho' Poor and Wretch'd as it is, it has happen'd a little unluckily for him, to be set off with a Mathematical Figure or two, and the Appearance of some little Mathematical Reasonings and Calculations: And whether upon that Account, I know not, but the honest Gentleman has the Misfortune to be believ'd by most People to have no more Title to it, than to some other Things of greater Value, which some time ago he would have pass'd upon the World for his own, if the World would have believ'd him. But 'tis an unbelieving World we live in, and some People too well know, there were Things there exceeding his Ways of Thinking: And tho' they had lost of their Lustre through course  
Hand-

Handling, and the coarse Stuff that was blended with them, 'twas still easy to discern whence they had been taken. 'Tis indeed strange, one should so boldly adventure upon Stealing, that has not the Skill to go about it more handfomly; nor the Conduct to Manage what he Steals to better Purpose. For he did but botch and confound all, did but spoil and fally some good Thoughts pick'd up from others, with impure Mixtures of his own (God knows what ) sad and fulsom Stuff; of which it were easy to give a particular Detail, if it were needful : But the Books themselves are publick, and the Intelligent Reader has but to Read and Consider them, compar'd with Pages 83, 84, 85, and 86. of Doctor *Pittairn's Dissertation De Legibus Historie Naturalis*, and be satisfied of the Truth of what I say: For I design to confine my self to the Libel that lyes before me.

The true Author of which, it seems, has thought to ly cover'd, or under his Friend's foolish Conduct, or under your borrow'd Name; tho' generally People here make as little doubt about him, as ye do in *Scotland*. And were there no Presumption from other Matters of Fact, as there are some very shrewd ones, 'tis Allעדg'd, the Piece it self bears the true Stamp of it's Author: That saucy Magisterial way, that Pride and Vanity, that gross Rudeness, that Scurrility and Spite, and these other Peculiarities of the unmannerly Stile that reigns through the whole, are not to be Match'd every where. Such as are best seen in our Modern Writings, know not where to find the Parallel, but in the late

**Works of a certain Gentleman,** if he deserves that Name, who was not ashamed to distinguish himself by Treating some of the best and greatest Men of this and former Ages with an Insolence unbecoming either Gentleman or Scholar.

For what, tho' he could prove some Escapes or Mistakes upon them? Is it so very extraordinary a thing for a great Man sometimes to make a Slip; or so very surprizing for a very ordinary Man to perceive it? That, when it comes in his Turn, he must assume such Airs of Superiority, and must think himself privileged to Treat far better Men than himself with what Disdain and Contempt he pleases to put upon them?

For my Part, I know no Pretension great Men have to Infallibility, more than others of an Inferior Understanding. They may indeed, when they set themselves about it, do things far exceeding the Reach of ordinary Men, but still they are subject to the common Infirmities of humane Nature; and are not Angels, more than the poorest Peasant. They cannot at all times (as we say) have all their Eyes about them, nor all the remote Consequences at once before them, which may be drawn from what they are advancing. They have their own weak Sides, and are lyable to their own little Prejudices and Passions, as well as other People. And there's no doubt, but that, when they have their Heads surcharg'd with a great many things together, something may escape their Notice, which a very indifferent Man, with little in his Head to distract his Thoughts, may easily observe; Or  
that

that when their Fancy is heated in the Pursuit of a Notion, that's agreeable to some little present Bias, they may be misled into Mistakes, which one of far less Penetration, but unbiass'd and in cold Blood, may easily see will not stand the Test; Or that, when they are tir'd out and exhausted after long and painful Researches, they may be even forc'd to unbend and relax, and to indulge themselves for a while in a looser way of Thinking. Or perhaps to recreate their wearied Spirits, they may be glad to sit down, and amuse themselves with a little innocent Romance in Philosophy, as others do in Love, while at the Bottom they well enough know, there is perhaps as little Reality in the one, as commonly is in the other. But what of all this? Why? An honest Man would thank them heartily, would honour and respect them for their other good Services, would easily over-look Slips of a lesser Nature, that draw no hurtful Consequences after them; would not grudge them their inoffensive ingenious Diversion; Or, if he found Mistakes of greater Moment, there's no doubt, but that for the common Service of Mankind and of Truth, he would be oblig'd to take Notice of them: But then he would take care to do it with that Civility and Respect, which is due to Persons of their Distinction: And when so gone about, 'tis an Office, which, no doubt, the greatest Man wou'd accept, and thankfully acknowledge, from the meanest. But to pass over all the good things we ow them, without the small Tribute of a cheap Acknowledgment, and in stead of this, to  
fall



fall foul upon them, Dead or Alive to revile and reproach them, without distinction, for a few Instances of humane Frailty, is a piece of Inhumanity, I believe, few but our Author could have been guilty of. Pardon, Sir, this short Excursion. 'Twas a Debt I could not but take this Occasion to pay to the Memory of some of these honourable Worthies, who cannot now speak for themselves; and to whom, for all the uncivil Usage our Author has shew'd them, We unquestionably ow the Foundations of those noble Superstructures, which are now so justly the Admiration of all the World.

But to come to my Friend, if it has been his mishap among others to fall under the Lash of this Gentleman's Pen, I know no Reason he has to be ashamed of some of the honourable Company he is joyn'd with; or to take it ill, he should meet with no better Usage than they. For 'tis not enough that what he has said is more surely founded, and may be better sustain'd, than some Philosophical Opinions, which they more unwarily advanc'd, as I hope to shew in the following Defence. Some People don't write for the sake of Truth, but right or wrong, true or false, if possible to expose the Person, that is the Butt of their Spite or Envy. And Demonstration it self is not secure against Malice, as long as Words may be wrested, or an unfair Consequence obtruded. Nay, if there's but a Typographical Error left, one that's upon that Lay will be sure to catch at it, and charge it upon the Author. If things themselves are  
too

too well secur'd, to be disprov'd, He'll fall nibbling and cavilling at the outsides and Circumstances of them : And twenty other oblique ways must be tak'n to lessen what cannot be destroyed. But such little Artifices are more noisy than hurtful. They may perhaps for a while surprize some weak People into a low Opinion of Persons or Things ; when with equal Judges their own merit will support them to the end of the World ; and the Blow, that was intended against others, will rebound upon, and end in the hurt of no Body but him that offer'd it.

Upon which Account I should be sorry, if the *Doctor* should sit down to throw away his Time (which he knows how to bestow to far better Purposes ) in an inglorious Scuffle with one so far beneath his Notice ; especially since there are so very few of the many useful Truths advanc'd and establish'd by the *Doctor*, which the *Libeller* has dar'd directly to impugn ; and the Objections he has brought against these few are so very inconsiderable, that every indifferent Reader may, without much Assistance, easily satisfy himself about them. Or if the *Doctor* will take that Part upon himself, in the new Edition of his *Dissertations*, which I hear he shortly intends, and will submit to the Trouble of taking off the apparent Force of some little Reasonings, that seem more directly to make against a few of his Propositions, 'tis the utmost length I think he should go. To dip further in the pitiful Quarrel, and pursue the *Libeller* through all the Cavils and idle Impertinencies

nencies, which make up the Body of his Book, in my humble Opinion, is altogether unworthy of the Doctor. But for once I'll try it for him.

In the very Beginning of the Libel, we have a Swatch of the Author's Spirit. The first seven Pages (tho' he would put another Face upon it) seem to be written with no other View, but to expose you as well as *Doctor Pitcairn*, and to rip up old Mistakes betwixt ye. In which howsoever, I hope, he shall find himself disappointed, since I'm confident, ye are now long ago satisfied on both sides, they were but Mistakes maliciously rais'd, and fomented by some officious People (much of our Author's Stamp) that wish'd well to neither of ye, and therefore they ought for ever to be buried in Oblivion: And I'm glad to understand, that in stead of wid'ning your Differences, this Attempt has rather serv'd to improve and confirm your Friendship together. Only give me leave to observe, That after he has put two or three Pitiful trifling Quibbles in your Mouth (far beneath you, or any Man of Sense) about the Notions of a *Problem*, and *Angle*, the Signification of *Densae*, and the Transcriber or Printer's Negligence in omitting the Word *Reciproce* in a Proposition cited from *Sir Isaac Newton*, &c. and dismiss you with that cold Defence for your self; He brings you in full of Zeal and Passion for the Honour of *Doctor Cockburn*, loading him with Praises, with high-flown Speeches, and extravagant Complements; and outrageously falling foul upon *Doctor Pitcairn*, for but doing Justice to *Bellini*, and Himself, against the modest  
and

ind discreet *Doctor Cockburn*, who (*Pag. 8.*) is not ashamed to praise *Bellini* more than himself; even when he is amending him, &c. In which Character, I believe, every Body but our Author, instead of Modesty and Discretion, will find the utmost Height of Arrogancy and Vanity. Sure I am, it would turn some People's Stomachs out once to see *Doctor Cockburn* stated in a Comparison with *Bellini*; or to hear our Author so foolishly and impudently assert, that the *Doctor* has really solv'd his Problem, about the proper Doses of vomitive and purgative Medicines: When 'tis found in daily Practice, that some Children require as great Doses as their Parents; and of two Persons of the same Weight and Temperament, as far as can be inferr'd from all the Indications we have, the same Dose that powerfully works upon the one, will not work upon the other. And tho' to the Weight of the Body he should join that of the Mind, and it's Thoughts too, according to the excellent Doctrine of his *OEconomia Animalis*, *Pag. 113*; I'm afraid he'll but little mend the Matter, 'twill be as bad Physick still, as it is Philosophy or Divinity, to which nothing can be more contrary, than attributing Weight, and consequently Materiality and Mortality to the Soul.

But here observe, how he seeks and creates to himself the Occasion he has taken to throw Scandal upon the *Doctor*, by putting these Words at the foot of *Pag. 8.* in another Character, *You took it for a Banter, and an Undertaking too great for the Capacity of a Man*, He would have the Reader to infer they were the *Doctor's* Words.

Words, that he might thereby force Room to have a Fling at him ; whereas the Doctor could no where have Occasion to speak of that Problem, it being posterior to all his Writings, as the Libeller himself owns in the very beginning of the same Paragraph.

By this time, Sir, I doubt not but you are satisfy'd, had it not been for the great Doctor *Cockburn*, Doctor *Sibbald* should never have been consider'd by our worthy Author. But for my part, I believe he should have done a great deal more for the Vindication of Doctor *Cockburn's* Honour, if instead of those fulsom Complements, which he put upon him under your Name, he had given a pertinent and distinct Answer to the Charge that Doctor *Pitcairn* brings against him in the above-cited Pages 83, 84, 85, and 86. of his *Dissertation, De Legibus Historiæ Naturalis*. For which he had all the Reason in the World, since 'twas but to do himself Right against the Injury that was intended him by Dr. *Cockburn*, in so freely making use of his Papers, and very Words, as his own, without ever acknowledging the Doctor for them. So that in all this Matter, not Doctor *Pitcairn*, but Doctor *Cockburn*, was the first Aggressor. And for the Libeller himself, I truly believe Doctor *Pitcairn* never so much as Injur'd him in his Thoughts, unless he takes it for an Injury, that the Doctor did not only entertain kindly Dispositions to himself, but took all occasions in his absence, to do good Offices, especially in his own Employment, to his nearest Relations, as has been often acknowledged

l by themselves, and could not be un-  
n to him.

: it seems the Libeller was sensible 'twas  
rd a Task for him to answer the Charge :  
*illa lachryma* ; And therefore wisely indeed  
lines it, but wickedly takes himself to  
and Reproaches, where he has nothing  
to say. After the Scandal but just now  
on'd, I suppose you'll not be Surpriz'd at  
xt, That Doctor *Pitcairn* has *vice versa*  
l Pilferer from Doctor *Cockburn*, and stoln  
him the Experiment about the *Cantharides*  
*Transf. N. 252. Pag. 161*, which is a no-  
is Falshood in Matter of Fact. For to  
ertain Knowledge it stands thus. Mr. *Boyle*  
rov'd, there was no Acid in Men ; and  
or *Pitcairn* from the Consideration of the  
ns of the Stomach, and Circulation of the  
l, common to all Animals, especially as ac-  
ed for by Himself, very reasonably inferr'd,  
could be none in any other Animal. To  
m which Inference by Experiment, he  
l distill some *Cantharides* before Doctor  
urn's fulsom Paper was seen, as is well  
n to many in *Edinburgh* ; for the Matter  
to Secret there, but freely communicated to  
al both Physicians and Apothecaries : And  
e Experiment, as it is narrated by the  
r himself, in his *Dissertation, De opera quam*  
*nt Corpora Acida, &c.* we have the seve-  
roportions of *Spirit, Salt, &c.* which are in  
*Cantharides*, and which, after Mr. *Boyle's* In-  
on, was the only *Desideratum* in that Affair,  
Doctor *Cockburn* thought fit not to take

so particular Notice of them in his Paper prevent Suspensions of Theft. For, after I have said, I leave it to the Reader, whether is more reasonable to believe Doctor *Pitcairn* Pilferer from Doctor *Cockburn*, or Doctor *burn* did not rather make bold with Doctor *cairn's* Experiment, as he had done before his Books and Manuscripts. For I'm mistaken if Doctor *Cockburn* was not at *Edin* after that Experiment was made; and I should be Mistaken in this, it was easy for to have had Account of it from some Correspondents there. Let me observe to by the by, that, what Doctor *Cockburn* says in his Paper of his, about the External use of *pharides* and *Camphire*, is design'd against the ingenious Doctor *Groenvelt*, and is such Stuff worthy of Doctor *Cockburn* only, and the that endeavour'd to defame that worthy son.

Now, after the silly Defence he has made his Friend, comes our little Champion next. Act Offensively, and to make Reprisals Doctor *Pitcairn's* *Dissertations*. But I hope satisfy You he has succeeded no better in last than in the first Attempt.

The first thing he Attacks ( *Pag. 10.* ) Doctor's Method for determining the Angle made by the Section of a Distractile Canal a plain Perpendicular to its Axis. And he has shew'd the Cunning of an insidious throat, more than the Bravery of a general Enemy. He found the Transcribers or scribes had spoil'd and mangl'd the Place.

sneakingly resolv'd to make the best of his Opportunity, lest he should not have found such an Advantage again. But that you, Sir, and every candid Reader may judge for your Selves, and not rely upon the Faith of my single Assertion, I shall Transcribe the Words themselves, *Pag. 28. Line 4. of the Doctor's Dissertations.* They are these; *Ut hac inveniatur facillime, Curva representetur per infinitas numero Rectulas, in quas cadant Perpendiculares longitudine æquales, representabunt hæ lateralem Fluidi pressionem : verum (quia hæ omnes faciunt cum se invicem Angulos) producta necessario concurrent. Quare res eo deducitur, ut inveniatur Curva, cujus omnes Subtangentes in puncto concurrant. Norunt autem omnes Geometra hanc esse solum Circulum. Ergo Fluida quæcunque sibi permessa necessario formabunt Canalem, cujus omnes Sectiones ad Axem Perpendiculares erunt Circuli.* Whereas the the true Reading should be; *Ut hac inveniatur facillime, Curva representetur per infinitas numero Rectulas æquales, in quas cadant Perpendiculares longitudine æquales, representabunt hæ lateralem Fluidi pressionem : verum (quia hæ omnes faciunt cum se invicem Angulos æquales) producta necessario in puncto concurrent. Quare res eo deducitur ut inveniatur Curva, cujus omnes Perpendiculares in puncto concurrant. Norunt autem omnes Geometra hanc esse solum Circulum. Ergo Fluida quæcunque vi Cordis propulsa, & sibi deinde permessa, necessario formabunt Canalem, cujus omnes Sectiones ad Axem Perpendiculares erunt Circuli.* Let me ask you now, are not these Corrections so natural and easy, that what is left sound of the Discourse, could have led any Body to them  
that



that understood the Subject? Especially, might not the Libeller have spar'd his Criticism upon the Word *Subtangentes*, since it stood Corrected, and the true Word *Perpendiculares* was restor'd in its place in the Printed List of *Errata*? And tho' it had not been Corrected to his hands, since it was *Perpendiculares* in the Premisses, could there be one so dull, as not to see it behov'd to be *Perpendiculares* in the Conclusion also? And of all the Omissions I have supply'd, is there any one Word, that ev'n Malice it self can alledge I have thrust in of Purpose or Design, to force or wrest the rest into any other Meaning than they plainly suppos'd or requir'd, to compleat the Sense? And will not therefore the judicious and honest Reader easily ascribe these Omissions to the Transcriber or Printers. For 'tis not the first good Book that has suffer'd in their Hands. And I must tell you, 'twas not the Author's own Manuscript that went immediately to the Press, but Copies of it Transcrib'd by other Hands, and sent to *Holland* to the Care of some People there, whom he thought he might safely Trust, since the hurry of his other Business could not allow him to Collate and Revise them Himself. And 'tis easy to Conceive, how either in Transcribing, or Printing, a few Words may have been omitted or mistaken; For my part, I rather Wonder that there are not more, when the Author's Eye was not over them. And I doubt not but the Word *Subtangentes*, which could not in Transcribing so easily be Mistaken for *Perpendiculares*, has been officious-

officially thrust in by some of these entrusted, perhaps young Students in Mathematicks, as (in their View) a Word importing more Learning than *Perpendiculares*, which was common. Nor am I sorry the *Doctor* has met with this Bite: I hope it will teach him, as it shou'd do every Body else, either to take the Trouble upon Himself to Revise and Oversee what he intends for the Publick, or to consider better of fit Persons to do it for him.

Thus having, as I hope to Satisfaction, vindicated the Passage in Controversy from the injury of Transcribers and Printers; I come next to defend it so restor'd against the Cavils of the Libeller. And after the but now mention'd Criticism about *Subtangentes*, first he tells us, "Tho' the Doctor has prov'd, that the *Perpendiculars* will meet, it does not from thence follow, that they must all meet in one and the same Point; and unless this be prov'd, he cannot demonstrate the Section to be a Circle: "That he seems indeed to assume without a Demonstration, That Perpendiculars can fall from one Point on all the Parts of the Curve, and that they are of equal lengths: *But is not this to assume the very thing he would demonstrate?* I Answer: The *Doctor* neither assumes that Perpendiculars of equal length, can fall from one Point on all the parts of the Curve; nor, because the *Perpendiculars* will meet, does he infer they must meet in one Point, but from the suppos'd Equality of the *Rectula* representing the Curve, and of the *Perpendiculars*, suppos'd to fall from without upon the said *Rectula*, justly he Con-

cludes

cludes these *Perpendiculars* to be inclin'd to one another at equal Angles, and therefore that produc'd they must meet in one and the same Point, and so as the Productions of them from the *Rectula* or Curve to the common Point of Concourse must all be of equal lengths; and consequently the Figure of the Section Circular. The Doctor's studied Brevity could not allow him to enlarge upon the Demonstration of a thing so easy, That every little School-Boy, who has but read the first Elements of *Euclid*, could make it out for himself. But if our Geometer will needs have a Demonstration, he shall not want it.

Let then (*V. Fig. 1.*)  $AB, BC, CD, DE, \&c.$  be the equal right Lines representing the Curve: Upon their middle Points raise (outwards) the equal Perpendiculars,  $FG, HI, KL, MN, \&c.$  representing the equal Lateral Pressure of the Fluid. Over the Extremities of those Perpendiculars draw Parallels to the right Lines representing the Curve. And upon account of that Parallelism, and the Equality of the said Perpendiculars, the outward Figure,  $OPQR, \&c.$  will be exactly similar to the inward,  $ABCD, \&c.$  that is, the Angles,  $OPQ$ , and  $ABC$ ,  $PQR$ , and  $BCD$ , and so furth, will be Equal: And as  $AB, BC, CD$ , and so furth, are equal among themselves, So will be  $OP, PQ, QR$ , and so furth, be equal among themselves. Whence 'tis manifest, That if from the several Angles of the inward Figure,  $ABC, BCD, CDE, \&c.$  we let fall Perpendiculars upon the outward Parallels, *viz.*  $BS, BT, CU, CX, DY, DZ, \&c.$  all the little Lines  $SP, PT, UQ, QX,$

$QX$ ,  $YL$ ,  $LZ$ , &c. will be equal among themselves, and consequently all the little Trapezia  $SPTB$ ,  $VQXC$ ,  $YLZD$ , &c. will be both similar and equal. But every little Trapezium is similar to its respective greater, viz.  $SPTB$  to  $FBH\Pi$ ,  $VQXC$  to  $HCK\Pi$ ,  $YLZD$  to  $KDM\Pi$ , and so forth: And therefore as all the Angles  $SBT$ ,  $UCX$ ,  $YDZ$ , &c. are equal among themselves, so will be all the Angles,  $T\Pi H$ ,  $H\Pi K$ ,  $K\Pi M$ , &c, equal among themselves. And as all the Lines,  $SB$ ,  $BT$ ,  $UC$ ,  $CX$ ,  $YD$ ,  $DZ$ , &c, are equal each to other; So all their Similars in the greater Trapezia, viz. the Lines,  $F\Pi$ ,  $\Pi H$ ,  $K\Pi$ ,  $\Pi M$ , &c, must be equal each to other; and consequently the several Perpendiculars,  $GF$ ,  $IH$ ,  $LK$ ,  $NM$ , &c, produced, must meet in one and the same Point  $\Pi$ , equidistant from all the little right Lines, representing the Curve, that is, the Curve must be a Circle, *Q.E.D.*

But now the Libeller Complains, that the Doctor should Assume "That equal parts of these  
 " Perpendiculars will represent the Pressures on  
 " the Sides of the Canal, that is, *should* assume the  
 " Lateral Pressures to be every where equal. But  
 " how (*asks he*) is that to be prov'd? I am sure  
 " it is not true, if the Axis of the Canal ly in  
 " a Horizontal Position, and the Fluid be left to  
 " it self; that is, if it have no Pressure, but  
 " what arises from its Gravitation, as (*he says*) the  
 Doctor supposes in his Demonstration. 'Tis  
 very true, the Doctor assum'd the equality of  
 the Perpendiculars, to represent the Lateral Pressure of the Fluid, and he had good Reason so to do, when that Pressure must be equal, where the  
 Sides

Sides of the Canal are Soft and Flexible, and the Fluid is Propell'd through it by any given *Vû*; as is the case of the Heart and the Blood Vessels. And 'twas but a fraudulent Misrepresentation of the Doctor's Sense to Interpret *Fluida sibi permissa*, by *Fluids left to themselves*, that is, which have no Pressure, but what arises from their Gravitation, as he would have the Doctor to suppose in his Demonstration. Sure I am, there was not a thought of Gravitation in his Mind, but of the Impulse of the Heart driving the *Fluids* through the distractile Canals, without respect to their Gravity: And by *sibi permissa* is plainly understood nothing else, but that, tho' we shou'd suppose the Canals of themselves lying flaccid, with their Sides clapp'd together, or form'd into any other Figure; Yet after the Action of the Heart, the Blood thrust into, and propell'd through them, would of it self, without any other Assistance, distend them into Cylindrical or Conical Figures, so as their Sections Perpendicular to the Axis should be Circular.

Thus having warded off the first Assault, 'tis time to take care of the second, which *Pag. 12* he forms against the Doctor's excellent and never enough to be admir'd Doctrine of the Continuity of the Veins with the Arteries. But for all the Triumph, he thinks himself so sure to carry, from the Instance of the Spleen, I doubt not to make it appear to every ingenious Reader, that it is *ante victoriam*, and that neither he, nor any Body for him, will ever be able to disprove that charming Speculation. But first I must tell him, he is either guilty of unpardonable Malice, for endeavour-

deavouring to give an unfair Representation of it ; or of unaccountable Ignorance, for not understanding what the *Doctor* has exprest with so much Life and Vigour. For, to put it in English to him (because it seems he does not understand the Doctor's *Barbarous*, that is, *Ciceronian Latine* : ) The very Soul of that Doctrine turns upon this precise Point, That the whole Animal Body, Flesh, Membranes, Bones, &c. is but one Canal or Tube, branch'd out, divided and subdivided into an infinite Number of Ramifications, carrying a Fluid propell'd through them by the force of the Heart. Which Tube, as it passes by different parts, as by different contrivances 'tis wreath'd up into different Bowels and other Animal Instruments, or in different parts serves for different uses, is called by different Names: Just as the same River is called by different Names, from the several remarkable Places it waters or passes by. Such parts of it as carry out the Fluid from the Heart to the Extremities are the *Arteries* ; and the Recurv'd Arteries, carrying back the Refluent Fluid from the Extremities to the Heart, are nothing else but the *Veins* ; and the Fluid in the Arteries and Veins is the *Blood* ; and the out-goings and returns of it, from and to the Heart, is what we call in a restrain'd. and limited sense the *Circulation* of the Blood. For the Blood is a mixt Fluid, and in its out-goings from the Heart at several places Discharges several less compounded Liquors, through other Ramifications of the Arteries, which from their general use are call'd *Glands* or *Secretory Vessels*, and are distinguish'd

by particular Names, according to their Situation, or different Liquors which they derive, or different uses for which that Derivation is made. Such are the *Nerves*, the *Miliary Glands*, the *Liver*, and *Ductus Cholidochi*, the *Pancreas*, and *Pancreatick Duct*, the *Seed Vessels*, the *Reins* and *Ureters*, &c. Some of these Glands, or Secretory Vessels reflow their Liquors into the Mass of Blood again, as the *Lymphatick*, which Discharge their *Lymph* into the returning Veins: Others derive their Liquors quite out of the Body, as the *Miliary Glands*, the *Liver* and *Pancreas*, &c. and these have their Mouths open to the outer Surface of the Body. For the inner Surface of all that great Canal, which in one continu'd Duct reaches from the Mouth to the Anus, is as much external to the Animal, and contiguous to the common Air, as is the Skin of our Hands and Faces. Nor need I to be misunderstood, when I say, the *Liver*, or *Pancreas*, or other Glands, derive or reflow their Liquors. 'Tis plain, I mean the Secretories of these Glands, which are but Branches of the Arteries, which together with Nerves and Veins compose the Body of the Glands. So that as the whole solid parts of the Body make but one continu'd hollow Tube; in like manner, all the Liquids do but make up one mixt Fluid, for the Watering and Nourishment of that Tube: And what is within or without that Tube, is only properly said to be within or without the Body. Imagine now the Heart to Act, and Set all this fluid Mass a going, and you shall have the full and adequate notion of the Circulation of the Blood.

While

ile all is moving, part of it is thrust out of Body ( never again to be refounded ) by the ffaries of the Glands, which terminate with 1 Mouths upon the outer Surface, the rest g and returning from and to the Heart in a etual Circle. No separate Cisterns there for ling Pools, nor Stagnation any where, but ie Case of an Obstruction, which is a Dif- or Preternatural state of the Tube or Fluids.

here now we are presented with a noble v of the Animal Body, that renders the Cir- tion, as it were, visible to our Eyes, or able to our very Fingers; with one of the test Wonders of the Material Creation; with of the best Arguments for the Infinite Wis- and Power of the Supreme Contriver. For does not see that such an Engine exceeds all 'owers of Mechanism? And before that No- of one Tube, and one Mass of Fluids in that e ( which we ow to the great Genie of Dr. *Harvey*, and for which alone, tho he had done no- g else, his Name deserves to be deriv'd down osterity with immortal Honour ) the Cir- tion of the Blood was never rightly under- l, was but an imperfect and unfinish'd Thing.

'tis no wonder People reason'd wrong a- it, while it stood as the great *Harvey* left 'Twas no wonder that, while the Arteries Veins were restrain'd to the narrow Sense ese Days, People shou'd have imagin'd to uselves solid Parts, Cisterns or Vessels, were distinct from, and no Parts of the mon Tube, and Liquors in these Vessels or rns that were no Parts of the common Mass;

Or



Or that thence should have sprung the Doctrines of Ferments, and differently Figur'd Pores, which the Doctor so elegantly and effectually disproves, in this admirable *Dissertation, De Circulatione Sanguinis per vasa minima*. And while he was shewing the Absurdity of these Doctrines, it was necessary for him to Argue upon the Principles which they suppos'd, or imply'd. For there are but two ways possible betwixt two Tubes to interpose a third Tube or Vessel, so as one Fluid, without Extravasation, may pass through all three. Either at the two Junctures of the Middle with the Extremes, the Extremities of the one must pass for some way, how little soever, into the Cavity of the other. In which Case, if the Vessels are hard and rigid, the Fluid may indeed be propagated through all three; but if soft and flexible, Dr. *Pitcairn* has Prov'd, and the Libeller agrees, it cannot be done, because of the Obstruction that must happen to the Tube, or Tubes, which in that Case will hang loose into the Cavity of the others. Or, at the said Junctures, the Middle with its respective Extreme terminates in one common Orifice, thus. ( *Vid. Fig. 2.* ) And then it is but one Tube, and we have the Continuity which the Doctor pleads for, and proves from the Obstruction that must happen in the only other Case. And therefore the Libeller was in the wrong for the scornful Reflexion he makes at the head of *Pag. 14*. " But this ( *viz.* " *Of the one's hanging loose within the other's* " *Substance* ) is a Supposition, that I believe no Body will make besides your Self, " and

“ and you wou’d do it only to make way for  
 “ your Demonstration against it. For, as was  
 said, in Flexible Canals, there is but that one  
 Case besides Continuity. ’Tis easy to foresee  
 and obviate the only poor little Shift the Libel-  
 ler has left to him. He’ll perhaps tell us, That  
 ’tis true indeed, if the middle Tube be of the  
 same Substance with the two Extremes, they’ll  
 make but one Tube. But if the one Extreme,  
 as *A*, is an Artery, the other *C*, a Vein, and  
 the middle Tube *B*, a piece of Flesh or Bone ;  
 (and why not of Glass or Flint ? ) Tho’ in a  
 certain Sense it may be still said they make but  
 one Tube, yet he may Alledge it cannot be  
 properly said, that the Vein is Continuous to the  
 Artery, since ’tis disjoin’d therefrom by the  
 Interposition of a Tube of another Substance.  
 And truly, I believe, this is a third Case,  
 which, to the World’s end, wou’d never have  
 enter’d into Dr. *Pitcairn’s* Head : Nor can I  
 guess what shou’d have brought it into the  
 Libeller’s, if it was not to have another Fling  
 at the Doctor. Pray, good Mr. Libeller, where  
 did you ever hear or see an Example of any  
 such Contrivance from the Anatomy of a sound  
 Body ? Or, tho’ you did, as in Diseas’d and  
 Old People the Arteries in some Places are  
 sometimes found Ossifi’d ( and so have I seen my  
 Self the Coats of some of the *Sinus’s* of the Brain : )  
 Do you think for this, the Ossifi’d part ceases  
 to be an Artery ? Or wou’d you say one Part  
 of the Artery is join’d to the other by the Me-  
 diation of an hollow Bone ? Truly this wou’d  
 be a way of speaking of your own. As long as  
 the

the Man lives 'tis an Artery still, tho' a vitiated One, that is, 'tis a Vessel carrying Blood from the Heart to the Extremities. But why all this Nicety? When you profess your Self of the same Mind with the Dr. in the rest of the Vessels, it wou'd really give one the Spleen, to see you discord with him only about the Bowel of that Name. Are your difficulties about it so insuperable, That to avoid them, you wou'd depart from that Uniformity and Simplicity of Contrivance, which together with the Dr. you acknowledge all the rest of the Body over. I'll ridd you of them at a less Expence. Do but look to Dr. Keill's Account of the Spleen in his little Treatise of Anatomy, P. 65, You'll find *the Spleen is compos'd of an Infinity of Membranes, which form little Cells and Cavities of different Figures and Bigness, which Communicate with one another, and which are always full of Blood.* And in the next Page, *The Spleen has Arteries from the Cœliack, whose Capillary Branches make frequent Inosculations upon the Membranes of the Cells. Its Veins, whose Extremities communicate with the Cavities of the Cells, as they come out of the Spleen, unite and make the Ramus Splenicus of the Porta.* Now, pray, reflect a little, and where the Anatomist's hand must stop, please but to Reason a step further with Dr. Pitcairn: And tell me then, what can these Membranes be, which form the little Cells communicating with one another, which are always full of Blood, and into which the Capillary Branches of the Cœliack Artery carrying the Blood to the Spleen, and of the *Ramus Splenicus* carrying it back from it, are so frequently Inoscu-

Inosculated. Certainly, not only Dr. *Pitcairn*, but a very ordinary Proficient in these Studies, from that Contrivance wou'd readily infer, these Membranes cou'd be nothing else but the *Productions* or *Propagations*, of the Coats of the said Blood Vessels, form'd by a thinner Texture of their Filaments spread out into a larger Surface; and the Cells nothing else but the very same Blood-Canals dilated or expanded into a greater Wideness in the Form of Vessels. And therefore, 'tis no wonder they shou'd be always full of Blood. And such of these Cells as carry the Blood outward from the Heart, or forward in the Arterial Duct, are in the most strict and proper Sense Arteries, as those of them are Veins, which carry it backward towards the Heart, or into the Branches of the *Ramus Splenicus*. Since they all of them, not only do make but one continu'd Duct, but the Coats of that Duct also are Compos'd of the same very Filaments; with this only Difference, That they are sometimes more, sometimes less closely gather'd together. If it is said, there are Muscular or other Fibres interwov'n with them in the Coats of these Cells: So are they also in the Coats of all the other Blood Vessels. Nor can I see any thing now further wanting for the Libeller's full Satisfaction in this Matter: For I cannot imagine He'll be so Absurd, as to Alledge, That either Artery or Vein shou'd lose its Nature, only for being Dilated into a greater Capacity, and gather'd together again into a lesser Channel; Or even for any Number of small Arteries spreading and interweav-

ing their Filaments with the Filaments of any Number of small Veins to Compose the Coat of one greater Vesicle, into which the Arteries pour their Blood : For if the springing Veins carry all that Blood backward towards the Heart ; and none of it is carried further than the Extremity of that Vesicle reckon'd from the Heart, that Vesicle, for all its Bigness, is an **Evanescent Artery**, or beginning Vein. For an Artery is not said to be Evanescant, or a Vein to be Nascent, because of its Minuteness, but for the Direction's being chang'd. Where ever the Tube is Recurv'd into a Course back towards the Heart, there is an **Evanescent Artery**, or arising Vein, tho' as big as my Finger : But if the said Vesicle, after 'tis gather'd together again at its remotest Extremity, shoots out Branches, that is, Arteries, carrying the Blood on to yet greater Distances from the Heart, that Vesicle is an Artery, not yet arriv'd at Evanescence, part only of its Blood being carry'd off by the little Veins which spring from it by the way. And the Body of the Spleen is nothing else but a Texture of Threeds of Arteries and Veins, much of the Form represented by this Figure, (*Vid. Fig. 3.*) interwov'n with Nerves, Muscular Fibres, and some few Lymphaticks.

And now after so full and plain Account of this Matter, I leave it to the Reader to judge, whether the Libeller had Reason for the fine Speech he makes, *Pag. 12. I like a Demonstration that disproves Matter of Fact ; but notwithstanding your Demonstration, that it is impossible, we are certain*

certain that there are *Veins and Arteries*, that are not immediately conjoin'd, but there is a *Large Space, Body or Interstice* between them. Perhaps you'll wonder at the Assertion, but I hope to make it plainer and easier to be believ'd, than you have made your *Demonstration*, that it is impossible. I shall instance in the *Spleen*, &c. I won't refuse but the Doctor had good Ground to wonder at the Assertion : But I'm confident neither the Doctor, nor any Body else is satisfi'd he hath perform'd, or ever will be able to perform, what he Undertook ; unless he calls a Part of the same Tube, expanded to a larger Cavity than that of the two adjacent Parts, the *Large Space, Body or Interstice* between the one Part and the other. But that is unfair Dealing, and, as I said above, either a wilful Misrepresentation, or an unaccountable Mistaking of the Doctor's Meaning, who never deny'd but that a Blood-Vessel might be widen'd and contracted again into a smaller Tube ; nor ever dream'd the wider Part could be call'd a *Space, Body or Interstice* interpos'd betwixt the two smaller Parts. And cou'd it ever enter into one's Head, in the Case of an *Aneurism*, to think or call the dilated or widen'd Part of the Artery, a *Large Space, Body or Interstice* interpos'd between the adjoining smaller Parts. The *Space, Body or Interstice*, which he speaks of, and disproves, is something distinct from, and no Part of the common Tube of the Arteries and Veins, as the Abettors of the Doctrines of Pores and Fermentations, before the Circulation was better understood, falsly suppos'd their Glands to be. Let his own

Words justify him. In the 17 Paragraph of his above cited *Dissertation*, Pag. 29. he says, *Ex hisce etiam deduco, inter arteriam evanescentem & nascentem venam, nullum intercedere spatium corpusve, quod possit, aut pro partium poris, interstitiisque, aut pro glandula haberi, &c.* And below in the same Page and Paragraph; *Neque enim interjacet glandula illa Poristarum media inter venam arteriamque orificiis porisque pro loci diversitate figura differentibus, aut fermentis instructa, sed glandula illa secretionibus inserviens est pars ejus canalis qui venam arteriamque efformat, &c.* Can the force of Words express a Thing more plainly? I agree with the Libeller Pag. 13. 'Tis something surprizing to observe the different Casts of Mens Heads, but I refer it to the Reader, whether Dr. *Pitcairn's* or His has been Cast in the better Mould. And whether the Account I have herogiven of the Spleen from the Doctor's Principles, is not more distinct and intelligible, more agreeable to Mechanism, and more consonant to the Simplicity and Uniformity of the whole OEconomy, than that of his wrapt up in vague and general Terms; viz. By *Large Pores*, in the stretch'd Surface of an unknown Body or Substance, into which, according to Him, the smaller *Capillaries* are *Inosculated*: Which is no better than the antiquated Stuff of *Substantial Forms*, or the exploded Jargon of *Occult Qualities* and *Materia Subtilis*, at which he has so heartily laugh'd Himself on other Occasions.

But 'tis now time to follow him to Page 14, where he would fain laugh at the Simplicity of the Doctor's general Theory of *Secretion*, which he ac-

counts

counts for, from the easy Principle of the different Diameters or Orifices of the Secerning Ducts. But the Objections he brings against it, *Simple* as it is, in the next *Pag.* 15, are indeed so wretchedly Silly and Ridiculous, that I'm almost ashamed either to repeat them, or to form any Answer to them. He allèges, 'If this were all that's needful to explain Secretion, there could be no Secretion of any simple Fluid, besides that which consists of the finest Parts; and that there can be no Secretion of the grossest Fluid, whose Parts compose the Blood. For its Particles having the largest Diameters, whatever Orifice admits them, will admit all the rest of the Particles of the Blood, whose Diameters are less; consequently they entering with the largest, there can be no Separation, and the Fluid Secern'd will be of the same Nature with the rest of the Blood. And to the same Purpose, at the end of this Paragraph, *Pag.* 16. He adds, 'It necessarily follows, there can be no Liquor Secreted from the Blood this way, but what must be thinner than the Blood it self. But there are several Liquors Secreted, that are thicker than the Blood; Therefore (*says he*) it is plain, that your (*the Doctor's*) Hypothesis is not sufficient to explain Secretion. Fine Reasoning indeed! I tell him a great part of the finer Parts, which compose the Blood, may be carried off by smaller and finer Vessels, before the rest of it arrive at the Orifice of the Duct appointed for the Secretion of the grosser Fluid; and what yet remains of the finer Parts

to



to enter the Orifice of that Duct, together with the grosser, may be afterwards deriv'd from it, in what Proportion he pleases, by Ramifications arising from the Body of the said Duct, in different Proportions, smaller according to the different Size of the Particles needful to be carry'd off; that the remaining Fluid, what by the grossness of the Particles which are left, and what by the extreme slowness of the Motion that must happen in these long and winding Canals, may acquire, if he pleases, a much greater Degree of Thickness than the Blood it self, whose Parts are broken and kept separate by the Rapidity of the Stream in the Arteries and greater Vessels, while under a more languid Motion in the Secretories, they have time to coalesce and unite without Disturbance. And hence it is, that the *Liquidum Nervorum* is among the most viscid, as well as most slowly moving Liquors of the Body, tho' it has generally been believ'd otherwise. And as to what he subjoins to the foot of *Pag. 15.*

' Then next for the Fluids that are of a mean  
 ' Thickness between the greatest and the least,  
 ' they must consist of all the Particles that are  
 ' in the Blood, whose Diameters are less than  
 ' that of the Orifice of the Secerning Duct,  
 ' and they will be mixed in the same Proportion,  
 ' that they were in the Blood before Secretion.  
 ' For the Blood being every where uniformly  
 ' mixed, all the different sorts of Particles will  
 ' arrive at the Mouths of the secerning Ducts,  
 ' in the same Proportion that they have to one  
 ' another in the Blood before Secretion, and  
 all

enter, whose Diameters are less than the  
meter of the Secreting Ducts ; Therefore  
different Particles that compose the Se-  
creted Fluids, must have the same Proportion  
one another, as they had in the Blood be-  
fore Secretion. By no means does it follow ;  
the parts that are smaller than these of a  
Thickness, may in different Proportions  
be dispos'd of, either before arriving at, or  
entering into the Secretory destin'd for  
forming the Parts of a mean Thickness, just as  
was said before of the thickest or grossest Parts,  
in respect to all that were finer. What an-  
swers both Cases. I'm assur'd to  
go further in a Matter so plain and easy.  
indeed 'tis a Scandal to see one put such  
an instance in so trifling a Difficulty, as if it  
were insuperable, when it can be no sooner  
pos'd, but the Answer must be obvious to  
every Body that knows but a little of the Ani-  
mal Economy. And the Scandal is so much  
greater still, that this Matter has been ex-  
pressly consider'd and accounted for, much af-  
ter the same way as I have here done, long ago  
Dr. Morland *Phil. Trans. Numb. 283.* and  
very lately by Dr. Keill in his *Account of Animal Se-  
cretion*, &c. And now after all this fine Rea-  
soning of the Libeller, I would have you, Sir,  
consider, whether there was Reason to sub-  
tract the civil Complement he bestows upon the  
Author, in the middle of *Pag. 16.* *If I were as  
confident on this occasion, as you are on all occasions, I  
should call this a Demonstration.* Truly, were I  
as confident as he, I would not stick to say, I

find no Demonstration here, but of the Var and Weakness of the Demonstrator.

Do but observe now, how he lyes at the Cat how sharply he looks out, and how narrowly goes to work for another Opportunity, to hit a Fling at the Doctor. In the said *Dissertation, Circulationis sanguinis per vasa minima*, against which he has made so much vain Struggle, Pag.

§ 20. We have these words: *Tanque ad hanc illustrandam profuerit adnotasse, quod, positis vasis cernentibus orificii equalis, scilicet. quae ex iisdem aequalibus locis ad similia fluida deferenda consurgit.* Where the word *equalis* has happen'd to be printed for *inequalis*: And that poor Typographical mistake must afford us the discreet Paragraph at the foot of the Pag. 16. *Before I enter this Dissertation, I cannot but take notice of a slip I have made. It is the 20 §. where before a Proposition you premise a Supposition, That two discerning Livers of equal Orifices, and in the Proposition it self suppose them to be unequal, the quantity of Sections being, as you say, proportional to the Orifices, there being nothing else to make the difference. You have strange ways with you, sometimes you give us a Supposition in your Proposition, which is the very same with your Proposition: At another time you premise a Supposition, and immediately press the Contradiction of it in your Proposition. Can there, Sir, upon so little ground be any thing more spiteful and invidious, any thing more beneath the Gravity of a Scholar, or the Honour of a Gentleman?*

And now, we are advanc'd to Pag. 17, where he begins to muster up all his Forces, only to squ

Squeeze a little Air into the Sides of the Blood Vessels of the Lungs in Respiration. But before I come to consider the weight of the particular Arguments, I must tell him there lyes one general Prejudice against all, or most of them; That of whatever use the mixture of Air with the Blood may be to the Animal Life, there is the less need to force it in, through disputed and controverted Passages, that fresh Supplies thereof are incessantly convey'd into the Mass of Blood, together with the Chyle, by the patent and undoubted Doors of the Lacteals. Which Prejudice is of so much the greater Force, if 'tis but a small Quantity, and that too of the finer and more subtile Air which the Libeller pleads for, as sometimes he seems to pretend no more. For when the Mass of Blood is before hand impregnated, and so plentifully furnish'd with fresh Recruits, of even the grosser Air, continually going in by the Lacteals, of what need or use can we suppose that considerable Pittance more of the thinner Air, which he would have carry'd in by the Lungs? Or, if any use or purpose could be better serv'd, or cou'd any Phænomenon be better accounted for, from the Admission of a little of the finer Air, by the shorter way through the Lungs, than by the contrary Supposition, 'tis plain the Doctor has not shew'd much Disposition to Contest or wrangle with him about it. For *Pag. 41*, of his *Dissertations*, he tells us, *At quibus omnis per pulmonem de-*  
*volvitur sanguis ( ut in homine jam respirante fit ) ea*  
*animalia statim concidunt, si excludatur non pars il-*  
*la subtilior, sed aeris crassioris moles é vesiculis pul-*  
*monariis; aeris, inquam, crassioris ea moles, qua pul-*

*monares vesiculas inflet explicetque.* Let us see then what his Arguments prove, whether they infer any necessity of that little Air's so piercing the sides of the Blood-Vessels of the Lungs, or if they may not all of them be sufficiently answered without that Supposition.

And first, As to the Experiment of the strong Tube made of the very thickest Part of an Ox's Hide, which the Air passes through under the Circumstances describ'd, *Pag.* 17; it does not from thence follow, that it must pierce the two Sides of the Blood-Vessels also. The Circumstances differ in several Respects. We have indeed in the one Case a very strong Tube, and in the other but very weak Membranes; but then the Force exerted upon the Membranes is far less than that imploy'd against the Tube: And were it proportionally less as the Strength is, or more than so, the thin Coats of the Blood-Vessels would make as powerful, or a more powerful Resistance against the less Pressure of the Air, than the strong Tube wou'd do against the greater. The Libeller does not determine the Proportion of the Forces, as he shou'd have done before he made any definite Conclusion, but grants at least *Pag.* 18. *'Tis much smaller* against the Coats of the Blood-Vessels, than upon the Tube, And therefore, at least (because I'm unwilling to exceed his own Concessions) The Resistance of the Blood-Vessels against the Air that presses upon them, cannot be much smaller than the Resistance of the Tube, against the Air that presses upon it. We shall have enough to make up the Odds, and cast the Balance

lance too from other Circumstances. For I wou'd have the Libeller to consider, that the Resistances we have been now comparing in the Tube and Blood-Vessels, are the Resistances against their being Rent or Torn asunder, not against admitting of the Particles of Air through their Pores, which are quite different Considerations, the one depending upon the strength of the resisting Bodies, the other upon the closeness of their Texture. Thus a wide Iron Grate is incomparably a stronger Body, and wou'd require an incomparably greater Force, to rent or break it, than a piece of fine Linnen; yet the Linnen, because of its closer Texture, is far more impervious to the Air, than the Grate. The same way, tho' the Libeller's Tube is far stronger, and wou'd require a far greater Force to break or burst it asunder, than the Coats of the Blood-Vessels, yet the last may be of a Texture so close, as to be more impenetrable by the Air than the former. And that it is so in Matter of Fact, we have all the Reason in the World to believe, because the Filaments of the Blood-Vessels are exceeding small and fine, and can therefore be brought much closer together than the courser Filaments of an Ox's Hide. But this is not all, the little Interstices or Pores left between the Filaments of the Blood-Vessels are always repleted with a viscid glutinous Substance, if not altogether, at least more impervious to the Particles of Air, than the wider Interstices between the Filaments of a dry'd Hide, from which all or most of that glutinous Substance is

evaporated. Nay, the Filaments themselves of the Blood-Vessels, from the Moisture with which they are still impregnated, are contracted in their length, and swol'n to the breadth. Upon which account they incroach further upon; and straiten the little Interstices between them; both in length and breadth, more than they wou'd have done without that Moisture: While on the contrary, the Filaments of dry'd Leather, after the Moisture is in great measure drain'd from them, are contracted in their Breadth, and stretch' to the Length, and thereby leave their Pores or Interstices wider in all their Dimensions, than before that Moisture was exhausted. The same Moisture keeps the Filaments of the Blood-Vessels alwayes soft and pliant, and therefore less apt to break than the half wither'd Filaments of dry'd Leather; which, after the Moisture is exhal'd, are render'd so free and brittle, that the Leather cannot be wrought or bended into the Form of a Tube, but severals of them must be rent and broken. So we daily see that all Substances, which are naturally full of Juice and Sap, after drying separate and burst out into a great many little Crannies, Cracks, or Flaws, that are easily pervious even to the grossest Air. And to these two Considerations together, of the closeness of the Filaments, and the Repletion of the little Interstices between them, is owing the Phænomenon of a blown fresh Bladder in the Air-Pump; where the imprison'd Air has no Exit through the close Sides of the Bladder, till the Air in the Receiver is so rarify'd, that the prevailing Elasticity of the Air in the

Blad.

adder becomes too strong for its Prison-walls, and bursts them into pieces. And no doubt the same wou'd happen to a Piece of the finest Wood-Vessel blown with Air, and ty'd at the extremities. So that we have no Ground to extend, that even the finest Air pierces its sides, more than it does the Sides of a Glass-vial, which bursts in the like Circumstances, before the included Air can get out. Which still further confirm'd from that other Experiment of a well blown Bladder, with a great weight in it, which tho' suspended in the open Air, for all the Weight that stretches its laments, gives no Passage to the included Air, 'tis sunk under Water, where the ambient Water dissolves the Gluten lodg'd in its Pores; such neither the included nor ambient Air will do. And the same way the little Crannies the dry'd Pitch (from which 'tis never free) the Passage to the ambient Water into the Sheep's testines, and other Stuff, of which our Libell's strong Tube is made, which dissolving the Gluten that is left in the Pores of these Substances, facilitates the Air's Exit through them. And as to the Force of moisture in shutting up or straitning the Pores of moisten'd Bodies, we cannot desire a more positive Instance, than what we have from the new way of defending the exhausted Receiver against the Ingress of the circumambient Air, which is done by spreading only a piece of tanned Leather upon the Plate of the Pump on which the Recipient is plac'd. And this easy and simple a Contrivance affords



a better Security against the insinuating of the outward Air, than any the strongest Cement that can be thought of. For, as appears by the Mercurial Gage, no Air searches through the wet Leather, till the Moisture is evaporated, tho' in a very little time it makes its way through the best Cement. But further, still 'tis to be consider'd, that the Blood streaming through the Vessels not only has its own share, in shutting up or straitning their Pores, but being alwayes stor'd with abundance of Air, of the same Density with that which we breath in, deriv'd to it by undoubted Passages ; the Air within has as good a Lay to be thrust out, as the Air without to be thrust in through the sides of the Vessels, by the same force of the Breast, acting at the same time and in the same way towards both Effects ; nay, and a much better too, if the matter is rightly consider'd: For the Air from within, pressing outward, stretches the Coats, and enlarges the Pores of the Vessels, by which perhaps it may get out, when the Air from without, pressing inwards, contracts and makes the Coats of the Vessels to shrink up, and thereby so straitens their Pores, that it cannot get in. So that 'tis far more probable, that part of the Air which was in the Mass of Blood shou'd be discharg'd from it, than that any new Air shou'd be convey'd to it through the Pores of the Blood-Vessels of the Lungs in Respiration. Tho' from the fore-going Considerations all taken together, I believe neither of the Cases happens : And I take it to be highly probable, that no Air either enters by, or escapes through the Pores of  
the

the Vessels ; I say, through the Pores properly so called, that is, the little Interstices left between the Filaments which compose the Coats of the Vessels. For there's no doubt, but that abundance of Air is perpetually carried off from the Mass of Blood, all the Body over, together with the Matter of other Secretions. But then that is done by the Tubes of the Secretories, and not through the Pores or Interstices of the Filaments of the Vessels ; through which I see no Reason why the Air should either pass or repass, but rather think the Considerations I have adduc'd sufficiently prove the contrary. Certainly the grosser Air cannot pass or repass ; for if it cou'd, the Respiration shou'd be quite eluded. And I see no use for the finer. Or if the Libeller will needs have Passage for the finer and more subtile Air, I have shew'd, it must rather be out from, than into the Vessels. At least I think I have put it beyond Dispute, that the Air's forcing its way through his strong Tube is no Argument at all, why ev'n the finest Air shou'd be allow'd to make its way to the Blood, through the Pores of the Blood-Vessels, when betwixt the two Cases there are so many and so widely differing Circumstances, as I have shew'd to the Prejudice of his side of the Argument, and to the Advantage of the other.

*Page. 18,* The Libeller seems to Banter rather than Reason, when he prays the Doctor to ' Look over his Staticks, and reflect on the nature of ' Fluids, *which*, when they are press'd, endeavour ' to recede by all wayes from the Pressure, and ' by that means will endeavour to get through ' the

' the sides of the containing Vessel, as well as  
 ' through any open Orifice in it. No doubt they'll  
 endeavour, but 'tis not the first fruitless Endeavour  
 that has been made, as this must be, if either  
 the Pores of the Vessel are too small for the  
 Particles of the pressing Fluid, or fill'd with another  
 Substance able to stand its ground against them:  
 Which I have shew'd to be the Case of the Blood  
 Vessels, by Arguments which the Libeller is not  
 able to overturn. At the foot of this same *Pag.* 18. we have  
 so excellent a Specimen of the Libeller's miraculous  
 Talents in the Art of Reasoning, that I cannot  
 forbear to transcribe it for the Instruction of the  
 Reader. He tells us then (speaking to the Doctor)  
 ' You own the Pressure of the Air to be so great,  
 ' as to comminute the Particles of the Blood, and  
 ' dissolve their Cohesions. Now, if the Sum  
 ' of all these Pressures on the Sides of the  
 ' Blood-Vessels, be any thing greater than the  
 ' Sum of all the Resistances, that the Sides of  
 ' the Blood-Vessels have to the Entrance of the  
 ' Air, in that case there will alwayes some  
 ' Air get into the Blood. And that the Solemnity  
 ' of a fine *Calculus* might not be wanting.  
 ' To make this Matter as clear as we can, let  
 ' us bring it into Numbers. Suppose the Pressure  
 ' the Air suffers at an Expiration, be to the  
 ' Resistance of the Coats of the Blood-Vessels;  
 ' as 1000 to 999; then in that Case, if the Air,  
 ' that is forc'd out of the Lungs at an Expiration,  
 ' be divided into a 1000 Parts, one of these  
 ' will pass into the Blood, and the other

' 999

' 999 will go out by the *Aspera Arteria*. Was ever the like heard of? Pray, good Mr. Libeller, do you know what follows from a *Supposito quolibet*? Suppose then, as, from what has been already said, is far more reasonable to suppose, that the Pressure which the Air suffers at an Expiration, is to the Resistance of the Coats of the Blood-Vessels ( not against being rent into pieces ). but against admitting of the Air through their Pores, as 999 to 1000, and then none will pass at all, but all will be thrust out by the *Aspera Arteria*, except some little quantity that remains latent in the Vesicles of the Lungs, which after the first Respiration are never again left quite void of Air.

Page 19. He tells us, ' That all Liquors have a Facility to admit the Air into their Interstices — And since the Particles of the Blood are divided in the Lungs, and further remov'd from one another, why may it not be allowed, that the Air being pressed, may get in between them? No doubt it might, if it cou'd have but Access to them through the Coats of the Vessels: But that is what the Libeller cannot prove, and which I refuse upon very good Grounds, some already adduc'd, and others to be yet added in their proper places.

As to the Argument he brings from the *Phænomenon* of the diving Bell sunk sixty eight Foot under Water, Page 19, 20, and 21. to prove, ' That the Air does not actually make its way through the Pores of the Membranes into all the Cavities of the Body, which have no Com-

' munication with the external Air.—For if  
 ' the Air in the Bell had no Admission into the  
 ' Cavity of the Thorax, the Air that does there  
 ' surround the Lungs, cou'd by no means resist  
 ' the Pressure of the Air in the Bell, which is  
 ' three times greater than that of the Air  
 ' within the Body, which endeavours to ex-  
 ' pand this Cavity ; and by such a pro-  
 ' digious Overplus of Pressure, the whole  
 ' Ribs and Parts of the Body containing  
 ' this Air, wou'd be dislocated, or the Sub-  
 ' stance of the Lungs torn to pieces, to  
 ' make way for the external Air to enter the  
 ' Cavity. For to shew this by Numbers, &c.  
 Surely if the Libeller had not taken care to  
 tell us (*Pag. 11.*) *He had read some Geometry,*  
 we cou'd never have guess'd at it from his way  
 of Reasoning, which we have now so often  
 found so very Ungeometrical. Does it look  
 like a Geometer to go out of his way for a di-  
 ving Bell, when the very Air he daily respires  
 can serve his Purpose as well? 'Tis true, the  
 Air in the Bell after it is sunk sixty eight  
 Foot under Water acquires a Pressure triple to  
 what it had before Immersion, and exceeds that  
 of 5000 *lib.* weight. But 'tis as true, the Pres-  
 sure of the common Air we daily respire is little  
 under 2000 *lib.* weight. And, but let the  
 the Libeller tell me, how his Body enjoying the  
 free use of Respiration daily sustains the Pressure  
 of 2000 *lib.* weight without feeling any great  
 Pressure or troublesome Sensations, and I  
 shall quickly account for the Diver's sustaining  
 the whole 5000. Hitherto I was willing to be-

believe, 'twas only a little of the more subtile Air that he was pleading might have Access through the Membranes and Coats of the Vessels. But now 'tis plain from his way of Reasoning here, and from the like Stuff he has about *Harvey's Problem*, *Pag. 25*, That he Supposes the very grossest Air we breath in freely to pass and repass through all the Parts of the Body, as through a Sieve: A Supposition indeed Geometrically calculated for maintaining the Equilibrium betwixt the internal and external Air, and for preventing our feeling any uneasy Sensation from the Pressure of the outward Air. But what then becomes of Respiration? I'm afraid 'tis gone and lost for ever, and to the World's end he'll never be able to account for it, if that Supposition stands: Which leads me at the same time more particularly to consider that other Argument, Objection, Doubt or Question, or by what other Name shall I call that Stuff he has about the said *Harvey's Problem*. For what clears up that, will quickly bring us to a right Understanding of the *Phænomenon* of the diving Bell. The whole Paragraph is worth the transcribing, for the Sublimity of the Thought, and excellent Philosophy which shines in it. He tells us then, *Pag. 25*. ' Tho' in this Dissertation you ( the ' Doctor ) have propos'd the Solution of *Har-* ' *vey's Problem*, yet I cannot see you have sa- ' tisfy'd all the Difficulties that occur in this ' Matter. For I desire to know how it comes, ' that an Animal breaths when it first comes ' into the World. You say, the Air rushes into

' the Lungs, being pressed by its Gravity and  
 ' Elastick Force, as into a Place that does not  
 ' resist its entrance, and that this is done be-  
 ' fore any Dilatation of the Thorax. But pray  
 ' consider this a little better; I think from  
 ' what I have already said, That all the Cavi-  
 ' ties of an Animal's Body must be constantly  
 ' fill'd with Air, and even the Cavities that  
 ' are in the Body of the Fœtus, whilst in the  
 ' Womb, must have Air in them of the same  
 ' Density with the ambient Air; And there-  
 ' fore when a Fœtus comes into the World,  
 ' and is taken out of the Teguments that in-  
 ' volv'd it in the Womb, there must be Air in  
 ' the Cavity of its Thorax, which being en-  
 ' dow'd with the same Gravity and Elasticity  
 ' as the external Air, will resist the Admission  
 ' of more Air. And 'tis the same Case in  
 ' Animals that live in the open Air; for  
 ' it will not enter the Lungs, unless the  
 ' Cavity of the Breast be first expanded.  
 ' I think therefore 'tis plain, that when  
 ' a Fœtus comes into the World, that the Air  
 ' will not rush into the Lungs, unless the Tho-  
 ' rax be first dilated, which is contrary to  
 ' your Assertion: Since then there can be no  
 ' Admission of the Air into the Lungs, unless  
 ' there be a precedent Dilatation of the Breast,  
 ' that is, unless the Muscles of the Breast act  
 ' and enlarge its Cavity, I wou'd know why  
 ' these Muscles shou'd just act then, and never  
 ' before.

From which Paragraph it appears I did the  
 Libeller no wrong, when I told above, that he  
 sup-

suppos'd the Air to have so free Passage through the Pores of the Body, that all its Cavities were thence repleted with Air of the same Density and Elasticity with the external Air that environs us, when he in that Paragraph tells us, It must be so even in the Body of a Foetus yet in the Womb, with respect to the Air which surrounds the Body of the Mother, upon which supposition give me leave now, good Mr. Libeller, to desire you even to take the trouble upon your self to answer your own Question, *I would know why these Muscles should just act then, and never before.* For truly I know no Body that's able to do it for you. But tho' I cannot tell you why they shou'd *just then begin to act*, I can demonstrate to you, if you please, why they *cou'd not just then begin to act*, but that either they must have been acting all along through the whole course of Gestation, or that upon their first Action (the time of which I leave to you to determine) the Foetus must have been Stiff'd in the Womb. For since there was all along a perfect Equilibrium between the Air in the Cavity of its Breast, and the external Air, together with the Waters included in the Teguments; there was nothing to hinder the Influx of the Animal Spirits, still flowing from the Brain, to exert their Office in contracting of the Muscles, which serve for dilating of the Breast, since the power of their Antagonist Muscles in respect of them is so small, that it may be neglected. The Breast thus dilated, either the Waters together with the Air wou'd have rush'd into its Cavity; in which Case the Foetus must have been immediately Stiff'd or Drown'd, or the



the Air alone after an unaccountable manner wou'd have rush'd into the Cavity, leaving the Waters without: In which Case true Respiration must have taken place, and the Muscles dilating the Breast shou'd have continu'd to act the whole time of the Gestation, as well as after the Birth, and taking the Fœtus out of its Teguments: Which I doubt not will appear a strange Paradox in Medicine. And by the same Argument, a grown Man may breath as freely at the bottom of the *Thames*, as on *London Bridge*, and Drowning is nothing but a silly Mistake among the unthinking Populace. But to be as favourable as I can, tho' I shou'd allow, that some unaccountable Power, which all the time of Gestation had miraculously suspended the Action of the Muscles, shoud just then leave them to the freedom of their natural Action, when the Fœtus is taken out of its Teguments; to what purpose cou'd even so ample a Concession serve you? 'Tis true, the enlarg'd Cavity of the Breast might receive more Air, but that flowing in so easily every where, the Air-Vessels of the Lungs, which are of no closer Texture than the Coats of the Blood-Vessels and other Membranes, giving free passage to it through their Pores, cou'd not be blown up, and the Respiration shou'd be still frustrated, without which we all know the Animal cannot live. And is this now your Geometrical way! Because Dr. *Pitcairn* to avoid these otherwise insuperable Difficulties, as well as upon other Considerations, inferr'd there cou'd be no such passing or repassing of the Air through the Pores of the Vessels,

, and that such Cavities of the Body, as  
 Communication with the open Air, must  
 have no Air in them, or but a little of the  
 subtle and most rarifi'd Parts of it, in Den-  
 d Elasticity far short of the common Air ;  
 for that think 'tis incumbent upon the  
 to account for Respiration, upon your  
 agant Supposition, which is quite con-  
 to his own? And must you upbraid him  
 t having solv'd *Harvey's* Problem, because,  
 e has done it from far better, he cannot do  
 n your absurd Principles? Truly that was  
 art to do, or I'm as far out in my Logicks  
 are in your Geometry. But let me tell  
 ow, had you seen as far into the Chain of  
 etrical Consequences as he did, you wou'd  
 ave discover'd the Impossibility of your own  
 and join'd in the same Conclusion with him,  
 ither there's none, or but a little of the most  
 e Air in the Cavities of the Body, which  
 no Communication with the open Air. Which  
 s all to go easily, and to hang together  
 somly. When the Fœtus is taken out  
 s Teguments, there being no Air, or none  
 what is of an inconsiderable Density or  
 icity in the Cavity of the Breast, which sur-  
 ds the Lungs, the external Air, press'd by  
 r greater Gravity and Elasticity, rushes in-  
 he yielding Lungs, which it immediately  
 s up, because it has no passage through them,  
 there's either little or nothing from with-  
 to obstruct their Distension, till they fill up  
 Cavity of the Breast, and cleave to its sides.  
 I now the internal Air counterpoising the

external, the Muscles, which before were i suffer'd to act for the great Pressure that lay u on them from the outward Air, without a Ballance from within, are set at liberty to co tract themselves, and dilate the Breast to a gre er Capacity, which makes room for a yet fi ther Admission of Air, and a yet greater Disti sion of the Lungs, till the Breast by its o weight sinks down again upon them, and squ zes out the Air the same way by which it. tor'd, untill again the Resistance from within comes too small for the Gravity and Elastic of the Air without ; and then begins a new. spiration, which is follow'd by a new. Expiri on, and so alternately till the last Expirati with which the Respiration ends, as it be with the Inspiration. And thus I think I h giv'n a plain and easy Account upon intellig and rational Principles, *Why the Muscles of Breast shou'd just then begin to act* ( and never fore ) when the Foetus is taken out of its Te ments, and how thence-furth, as long as the A nial Lives, Respiration must be produc'd : preserv'd by a Mechanical necessity.

It remains only to take off that other Diffi ty, which the Libeller thinks to ly so heav gainst the Doctor, viz. That great Overplu Pressure, which the Body must sustain fi the ambient Air, if the Cavities which have Communication with it, are not allow'd to be wayes full of Air of the same Gravity and I sticity to keep up the Ballance against it. have just now seen how that Counterpoise is : vided for in the Breast, by a proper and pecu

intrivance: As to the rest of the Body, the  
 utter will be easily made up, if the Libeller  
 calls to mind what I have told him before upon  
 other Occasion; that the whole Body consists  
 of one Tube, and one Mass of Fluids propell'd  
 through that Tube by the Force of the Heart,  
 which is it self but a Muscle, wonderfully con-  
 v'd and form'd for that Office from a Texture  
 some of the Ramifications of the same Tube.  
 The whole Cavity of this Tube enjoys a free and  
 disturb'd Communication with the open Air, not  
 Holes or Pores in its sides (for extravasated Air  
 is unnatural to the Animal Body as extrava-  
 sed Blood,) but by the Mouths of its extreme  
 branches lying open to the outward Air, fresh  
 supplies of which are alwayes rushing in by the  
 Arterials; (which is the only way of its In-  
 flux) to make up the loss of what is still car-  
 d'd off by the Secretory Ducts, together with  
 the matter of other Secretions; but chiefly by  
 the Conduits of insensible Perspiration, which  
 infinite Numbers terminate with open Mouths  
 on all the outer Surface of the Body. And  
 this is the only way of its Egress. It cannot  
 return back by the Mouths of the Lacteals, for  
 the Flood that is still rushing in: Nor can it  
 enter by the Mouths of the Secretories,  
 where the Stream that's still push'd out by the  
 impetus of the whole moving Mass: And this  
 continual Influx or Intermixture of the Air ren-  
 ders the whole Mass an Elastick Fluid. So we  
 see all Animal Bodies swell in the exhausted  
 receiver, from the Elastick Force of their Fluids  
 stretching and expanding the Canals, when the  
 G Pressure;

Pressure of the incumbent Air is remov'd. And from the Elasticity, in Conjunction with the great *Impetus* of the fluid Mass, deriv'd from the strong force of the Heart, and propagated and carry'd on with the Assistance of the Motion of Respiration, and of the Muscular and Elastic Force of the Coats of the Tubes themselves, we are furnish'd with a Counterpoise of sufficient power to sustain and defend the sides of the Tube against the Pressure of the external Air incumbent upon its outer Surface: For there being still a Communication perfectly free and open betwixt the external Air and the Air in the Tube, these Counteracting Powers can never rest, till they are reduc'd to a perfect Equilibrium. If the Pressure from without is too strong for that from within, the outward Air will rush with Violence into the Cavities of the Tube, to make up that Want. If the Pressure from within is too strong for that from without, the irruent Air will regurgitate and stop, till the Force from within is brought down to its due Poise, by the Efflux of part of the redundant Air through the Secretories: And during the Struggles and Reciprocations of these repugnant Powers, which can never fail to happen upon any sudden change of the Air we respire, the Animal cannot miss to be pain'd with troublesome and uneasy Sensations, nay, and perhaps to be extinguish'd too, if they are violent as well as sudden. But when that Reciprocation is at an end, or when that Change is gently and gradually made, the Animal is not troubl'd with a load of weight, or any other uneasy Sensation,

1 because the contending Powers softly and by  
 2 degrees without violence compose themselves in-  
 3 to a state of Rest and Quiet. And so much for  
 4 the Cavities of the Breast, and within the Tube.  
 5 And as for those without the Tube, which have a  
 6 free Communication with the open Air, as all  
 7 that great Duct betwixt the Mouth and the Anus,  
 8 no Difficulty lyes against them: But if there are  
 9 any Cavities so closely shut up betwixt the out-sides  
 10 of the Ambient Tubes, that there is no Commu-  
 11 nication left betwixt them and the External Air;  
 12 in that case, the whole Elastick Force of the  
 13 external Air being spent upon the Counter-  
 14 poise from the intermediate fluid Mass, and so-  
 15 lid Parts, which like so many Walls sur-  
 16 round these Cavities, nothing is left to press upon  
 17 them, but the meer weight, abstracting from the  
 18 Elasticity of as many Parcels of Air of equal  
 19 Dimensions with them, which is as good as no-  
 20 thing at all, and the weight of the solid and fluid  
 21 parts, which (as I said) like Walls environ them;  
 22 and these by the strength and contrivance of their  
 23 Structure, are more than sufficient to support  
 24 themselves. All which will find easy Credit  
 25 with such as will but reflect upon a Recipient  
 26 of brittle Glass, which, when exhausted of Air,  
 27 tho' endow'd with no counterpoising Power, main-  
 28 ly from the strength of its Figure, is able to with-  
 29 stand, not only the weight of its own Bulk of  
 30 Air, which is indeed little or nothing, but the  
 31 Elasticity too, which is very considerable, pro-  
 32 ducing a Pressure no less than what wou'd arise  
 33 from an incumbent Column of Mercury thirty  
 34 Inches high: And now from all taken together,

I think I may fairly conclude, 'tis as good as demonstrated, that tho' the Pressure of the outward Air, which we commonly respire, upon our Bodies is very great, and near equal to 2000 *lib.* Weight, yet being counter-poised with an equal Power, it can produce no troublesom or uneasy Sensation in us; being counter-pois'd, I say, by an equal Power, so easily accountable from Mechanical Principles, without running into precarious Hypothesis's of the Air's passing and repassing at random, (through God knows what) imaginary Pores, to the intire Destruction and Overthrow of the Animal OEconomy. And now that the Respiration in the common Air is fully understood, the Difficulty from the diving Bell is discuss'd with one Breath: For if the Descent is slowly and gradually made, as the Air in the Bell is by Degrees compress'd, so it furnishes a more compress'd Air to the Lungs, and to all the patent Cavities and Vessels in the Body; by which means the Equilibrium betwixt the outward and inward Pressure is all along easily preserv'd without any danger or trouble to the Diver. But if the Descent is so quick, that there is no time left for the onveying and distributing of the too suddenly compress'd Air into the said Cavities and Vessels, the prevalent Violence of the outward Pressure claps the sides of the Vessels together; and the Blood, having no other way to escape, is forc'd through the Coats of the Vessels, which are burst asunder to make way for its Egress. And that which the Libeller, *Page 21*, brought as an Argument for him, proves a powerful and cogent one against him. For if the Air had free passage every

every where through his imaginary Pores, the Air in the Cavities and Vessels would be compressed as fast as the Air in the Bell it self, and no Rupture of the Vessels shou'd follow.

In the same *Pag.* 21, he adduces another Phænomenon from Animals, ' that are frequently kill'd ' by infectious Steams and Effluviūms, which ' they draw in with their Breath; which, *he pre-* ' *tends*, is not to be accounted for, unless the Air ' that carries these Steams be suppos'd to mix ' with the Blood. He seems to despise the Ac- count the Doctor gives of this Affair, from the greater or less Gravitation of the Air, which al- ways accompanies these Steams, and by which the Respiration is stop'd, and the Death of the Ani- mal ensues. Is it possible (says he, *Page* 22) any Man ' can conceive that the small Effluviūms of Bo- ' dies should have such an effect on the Blood and ' Spirits, without being nearer them than the ' thickness of the Coats of the Vessels? Your Notion ' about the greater or lesser Gravitation of the ' Air, is no ways a sufficient Answer: For it ' is certain, that an Animal can live where there ' is ( *he shou'd have said* are ) much greater ' changes of Air as to Gravity and Levity, ' than what is produc'd by these Steams: And ' therefore your Answer is nothing to the Pur- ' pose. Yes, I say, 'tis perfectly to the Purpose, and not only very possible, but (after the Account I have just now giv'n of Respiration ) very easy to conceive, how either a very heavy or a very light Air, without approaching the Blood any nearer than the thickness of the Coats of the Vessels, may suddenly kill the Animal. If 'tis



'tis too heavy, or of too great Force, it will clap the sides of the Blood-Vessels of the Lungs together : If 'tis too light and weak, 'twill not be able to blow up the Lungs. In either of which Cases the Circulation is unavoidably and immediately stopt, and the Animal presently dies : And when the Death is sudden, it is altogether impossible to account for it, as the Libeller would do, by the Quality of the Steams, which together with the Air he would have to mix with the Mass of Blood : For whether the Steams have a Quality to condense and coagulate the Blood, or to render it too Subtile and Fluid, these are Operations which require time, and do not work their Effect so suddenly, as the Death which instantly follows upon the Animal's meeting with the Steams. I don't agree with the Libeller, that 'tis certain an Animal may live where there are much greater Changes of Air as to Gravity and Levity, than what is produc'd by these Steams. That's what he ought to have prov'd, and not to have assum'd with such a saucy Assurance. 'Tis true indeed, an Animal may live under very considerable Changes of Air, but whether so considerable as is produc'd by these Steams, 'tis not so easy to determine. Nor is the Animal able to bear these great Changes, unless they are slowly and gradually made ; If suddenly wrought, a sudden Period must be put to the Circulation and Life, easily accountable from the too great Levity of the Air not able to blow up the Lungs, or from the too great Gravity of it, suddenly clapping together the  
sides

sides of the Blood-Vessels in the Lungs, and thereby stopping the Blood's passage through them.

*Pag. 23,* He gives us one Phænomenon more of  
 ' an Animal; *which*, when shut up in a close  
 ' place, with an Air of the same Density and  
 ' Gravity with the external Air it commonly  
 ' breaths, will die in a very little time: But  
 ' if there be forc'd into the same place, when the  
 ' Animal is almost expiring, more Air, without  
 ' letting out any of what was there before,  
 ' the Animal will become thereby much exhilarated.  
 ' I know, (*adds he*) you say, The death  
 ' of an Animal proceeds from the greater Pressure  
 ' and Elasticity of the Air, occasioned by  
 ' the Heat of its Body: But I believe this increase  
 ' of Elasticity can never be so considerable  
 ' as to produce such an Effect, since the heat of  
 ' the Vessel is not discover'd to be very great.  
 ' And I think, I have shew'd that an Animal  
 ' may easily live where the Pressure of the Air  
 ' is triple; whereas the Pressure that arises from  
 ' the Air being heated cannot be above one  
 ' tenth of the whole. And therefore 'tis plain,  
 ' that such a small Change as this can never be  
 ' the cause of the Animal's Death. Besides,  
 ' when the Pressure becomes greater by the Intrusion  
 ' of the fresh Air, the Animal is so far  
 ' from dying the sooner for it, that it is much  
 ' reliev'd thereby. Excellent! Truly, Mr. Libeller,  
 ' I must own, all your Reasonings are of a piece,  
 ' and this is no worse than what we have had from you before.  
 ' You seem to love your ease, and to prefer a hasty superficial View  
 ' which is got without Trouble, to that solid Knowledge  
 ' which

which penetrates into the very bottom of Things, but is not to be acquir'd without labour and industry, in searching into their Causes and Effects, in considering them under all their different Views, in examining their Consequences, and comparing their Circumstances. Had you bestow'd some more pains this way, you might have sav'd a great deal of trouble both to your self and me; at least a very little thinking might have prevented this pitiful Objection. Put a little Animal into a large capacious Place, shut up as close as you please: Do you think for this the Animal must die? Certainly no, if it is sufficiently provided for in the other necessities of Life. Your Phænomenon then is not universal, reaching to all close Places indifferently, but confin'd to such as are of a small Capacity with respect to the included Animal. But why, you'll ask me, shou'd the Phænomenon hold in narrow Places, and not in larger, since 'tis Air of the same Density and Elasticity that is suppos'd to be shut up in both? Why? I'll tell you, The same *Momentum* produces a greater Effect upon a less *Impedimentum*, than upon a greater. There is a greater bulk or body of Air in the one Case than in the other, and the same Animal in both. The heat of the Animal's Body endeavouring to expand the Air that environs it, cannot fail to augment its expansive or elastick Force, when 'tis closely pent up and not suffer'd to diffuse it self through the open Air; But a less bulk, by the same cause, is sooner and more intensively heated than a greater; Therefore the Air in the narrower Prisons must become more Elastick  
than

than the wider : And the longer the Animal continues in the Confinement, the more is the imprison'd Air heated; and its Elasticity increases at a greater rate in a narrow than in a wider Place. The same thing may be said with respect to the Gravity of the two Airs compar'd together, The same quantity of Perspiration deriv'd from the Animal bears a greater Proportion, and therefore adds a greater *Momentum* of weight, to the less bulk of Air in the narrower Place, than to the greater bulk of Air in the wider. Let us see now what must be the Consequence of this Diversity; what different Influences these different Circumstances must have upon the Respiration of the Animal. In the wider Confinement, the Air drawn into the Lungs in Respiration is comparatively of little weight and Elasticity, and there's a great body of ambient Air, from which a sufficient Counterpoise may be deriv'd by the Lacteals to the Mass of Blood, to withstand the less Pressure upon the Blood Vessels of the Lungs, so as they may incur no danger of being shut; when in the narrower Place, after the Lungs are inflated with a more Elastick and more heavy Air, the little quantity that's left behind cannot afford matter enough to the Mass of Blood for a Counterpoise against the stronger Pressure, which consequently must clap together the sides of the Blood-Vessels of the Lungs, and stop the Circulation : So that 'tis demonstratively certain we may so far enlarge the one Capacity, and so diminish the other, that the Animal, which must be soon extinguished in the lesser, for want of a sufficient Counter-poise from with-

in against the great Pressure from without upon the Blood-Vessels of the Lungs, may live safely and securely in the wider, (and much more so in the open Air, ) where there is furnish'd a sufficient Counterpoise from within against a less Pressure from without. There's no doubt, but, as the Libeller says, an Animal may live under a much greater Pressure of Air than we can suppose to arise either from the Heat or Weight of the Air in these close Places where the Animal dies : But that is only in such Places as afford Matter enough of Air to the Mass of Blood by the Lacteals for an internal Counterpoise against the external Pressure. For 'tis not the Heat or Weight, or Pressure thence arising, that simply kills the Animal, but the prevalent Force of the Pressure from without above that of the Counterpoise from within. And what he subjoins as a mighty Addition to the Force of his Objection; ' Besides, when the Pressure becomes greater by ' the Intrusion of fresh Air, the Animal is so far ' from dying the sooner for it, that it is much ' relieved thereby ; is of no Force at all against, but rather serves to confirm what I have said. For by the Intrusion of more Air, a greater Body thereof is provided to furnish the Mass of Blood with the Counterpoise so often spoke of. So we have here from the Doctor a Rational and Satisfying Account of the Libeller's last Phænomenon from Mechanical Principles. Let us see now what is the Libeller's.

' It seems to me (says he, *Pag.* 24) ' That this ' proceeds from something in the Air, that is absorbed by the Blood, and when that matter is

' all

† all spent, as it must needs be by frequent Re-  
 † spiration of the same Air, that Air will be  
 † unfit for the further Conservation of Life;  
 † whereas when new Air is admitted, there  
 † will be more of this Matter, which some way  
 † contributes to the Performance of the Vital  
 † Functions. What this Matter is, or how it  
 † operates, I will not take upon me to deter-  
 † mine. I must confess, I don't know, nor did  
 † I ever see any thing satisfactory written on  
 † that Subject. Perhaps, if Philosophy be ad-  
 † vanc'd as much in after Ages, as it has been  
 † in this present, this will come to be found out;  
 † but at present, I see no way of discovering it.  
 What have we here now but Darkness and Ob-  
 scurity, but Words of no meaning, and Occult  
 Qualities, so often complain'd of in others by the  
 Libeller. *There is something in the Air, ( he  
 knows not what ) which some way ( he knows  
 not how ) contributes to the performance of the  
 Vital Functions ; about which something ( or no-  
 thing ) he never saw ( nor ever shall see )  
 any thing satisfactory written , but it may be  
 found in after Ages ( Ages of Eternity no  
 doubt he means, which is as good as never. )* Is  
 not this an excellent Speech now, and fine Re-  
 solving ! And is it not an Ingenious and Satisfa-  
 ctory Solution he gives of his own Phenome-  
 non ? If you'll please to hear me, I can tell you,  
 Mr. Libeller, some Air is necessary to all Fluids;  
 to assist in maintaining and preserving them in  
 their Fluidity, by thrusting in betwixt and keep-  
 ing their parts asunder : But the chief use of  
 the great Proportions thereof, that are still de-

riv'd by the Laſteals to the Maſs of Blood, and the main way by which it contributes to the Conſervation of Life, and to the Performance of the Vital Functions, is by the Counterpoife; which I have ſo often told you, it affords againſt the great Preſſure of the external Air incumbent upon the Body, and ruſhing in upon the Lungs; without which Counterpoife the Veſſels ſhou'd be clapp'd together, and nor Circulation nor Life cou'd be maintain'd.

The ſame *Pag.* 24. he falls very foul upon the Doctor for a very ſilly Cauſe. The Doctor had ſaid *ſ.* 12. *Pag.* 48. of his *Difſertations. Ex hiſce perſpicuum eſt aerem vaſa ſanguifera pulmonis non ſubire, cum eadem* ( ſo it is in the Doctor's Book, not *eundem*, as the Libeller is pleas'd to Print it ) *poſt mortem animalis os non obturati mole inveniatur in vaſe cui incluſum eſt, qua prius fuerat inſpiratus aut incluſus.* This the Libeller complains he does not underſtand: But truly that's the Libeller's Fault, not the Doctor's; And 'tis hard to Reproach the Doctor, only becauſe, when he has expreſt himſelf very clearly, and in very good *Latin*, the Libeller has not ſo much Skill in that learn'd Language as to underſtand him: But becauſe the Libeller owns he cannot, I'll do him the Favour to put it in *Engliſh* for him. And it is this; ' Hence 'tis manifeſt, that the Air does not enter the Blood-Veſſels of the Lungs, becauſe after the Death of an Animal with open Mouth included in a Veſſel, it is found of the ſame Bulk or Quantity in the Veſſel, which it had when firſt blown into, or ſhut up into that Veſſel.

• Vessel. This is the plain *English* of the Doctor's as plain *Latin*. And what is there so Mysterious and Unintelligible in either, as to deserve the unmannerly Reflexion of the Libeller, *Pag.* 25?

• What you have here said, you call a Phænomenon, and you take upon you to explain the Reason of it. In other Authors that write more clearly we can find out what they would prove from the Reasons they give; But it is my unhappiness here, as neither to find the Reasons, nor the thing to be explain'd by them. Truly I must agree with the Libeller, 'Tis indeed an unhappiness to be so dull, as not to understand so plain Language: And the best Advice I can give him upon it, is to revise his Grammar.

• Now after so many excellent Proofs of his deep Skill in Philosophy, and the mixt parts of the Mathematicks, *Pag.* 26. he begins to shew his extraordinary Talents in the abstract Parts, *viz.* Arithmetick and Geometry: And by his profound Knowledge in these, he doubts not to fix some terrible Absurdities upon the Doctor. Our Knowledge in things of a mixt Nature often stands upon loose and slippery Foundations; and ev'n great Men may sometimes go into quite contrary Opinions about them, without any blemish upon their Name: But 'tis otherwise in Arithmetick and Geometry, where every thing is demonstratively true or demonstratively false. Therefore nothing was to be neglected that cou'd infer a Scandal of this kind. He found, as he cou'd have wish'd, his good old Friends the Transcribers and Prin-



pers had furnish'd an handle from some Numbers they had vitiated in the Doctor's Calculations of the Muscles of the Breast, and of the Force of the Muscles which compress the Stomach, and of the Stomach itself: These he grasps at, and improves upon through seven Pages together, with all the Art he is Master of, with fine Rhetorical flourishes and little turns of spiteful Wit. Nay, and the Pomp of a Mathematical Figure or two must not be wanting to the Solemnity of the mighty Triumph; For now he is sure of an absolute Conquest, and that he has murder'd the Doctor's Reputation for ever.

I shall first consider what relates to the Force of the Stomach, and of the Muscles which compress it, tho' last in order with the Libeller. He tells us then ( *Pag. 30. and 31.* ), ' That  
' you ( the Doctor ) proceed on the Principle of *Borelli*, that the Force of all Muscles  
' is proportional to their Weight, and because  
' the Weight of the Muscle that bends the third  
' Joint of the Thumb is 122 Grains, and its  
' Force equal to 3720 *lib.* weight, and the  
' weight of all the Muscles that press upon the  
' Stomach is 8223 Grains: From whence you  
' say, As 122 Grains to 3720 *lib.* so is 8223, to  
' 248235. 'Tis somewhat strange, that so  
' great a Mathematician as you should not be  
' able to work the common Rule of Proportion;  
' or the Golden Rule, which every School-boy  
' knows exactly. Perhaps you have some new  
' way with you, or some other Notion of  
' Proportion than what is founded on the Ele-  
' ments

ments of *Euclid* : I am sure, if we take the ordinary Method which I learn'd at School, the fourth Proportional to the Numbers 122, 3720, 8223, is 250734, which Number does not agree in any Figure with yours, but in the first. And when you come to Calculate the Muscular Fibres of the Stomach it self, you suppose the weight of the Stomach to be eight ounces, which is 3840 Grains; and you say, according to the preceding Rule, the Force of the Stomach must be equal to the weight of 12051  $\frac{1}{2}$ . And here you must be exceedingly out in your Calculation, unless you have some Secrets in Arithmetick, such as you have in Physick : For, according to my Calculation, the fourth Proportional to the Numbers 122, 3720, and 3840 is 117088, which is almost ten times more than what you make it. 'Tis very true, the Transcribers or Printers have vitiated the two fourth Proportionals of the Doctor's Numbers, which the Libeller speaks of : And the Libeller has prov'd his Skill in Arithmetick by setting them at rights again. But what of all this? And why all this Banter? Because of a false printed Number or two, can nothing less content the Libeller, than that the World shou'd believe the Doctor has not so much Arithmetick as to be able to work the *Rule of Three*? Or is it possible he can think the power of his Eloquence so great, as to persuade them into that Belief? If Mistakes of this nature were to be charg'd upon Authors, how easily could I shew him the best Mathematicians

ticians in the World daily committing greatest Blunders. Nay, I cou'd prove to That Sir *Isaac Newton* himself, so justly adm all the World over for his profound Ski Mathematical Learning, cannot work the c mon Rules of *Addition* and *Subtraction* in w Numbers, which are Operations far less per than the *Rule of Proportion*. But what wou Libeller say, if I should have the Impudenc undertake to prove upon himself, that he not multiply the little Number 15 into it For ( *Pag. 29, Lines 4 and 5* ) twice over h for the Product 125, when every School knows it is 225. What *Euclid* was it that ta him to compound the Square of a Quantity sisting of two Parts, only from the Squar these Parts? Certainly the true *Euclid* wrote the Elements, cou'd have told him, 2. *Prop. 4.* that the two Rectangles of Parts were to be adjoin'd to the Squares of two Parts to compleat the Square of the w If he pleads 'tis the Printer's fault, not his, shou'd he grudge the like favour to Sir *Isaac ton*, or to Dr. *Pitcairn*. But to please th beller to his Heart's desire, let us suppo faults of these Numbers to have proceeded slips of the Doctor's own in the Computati them: Where is the Hazard of his Reputati there ever one that deals in Numbers, I conscious to himself, how ordinary and how a matter it is to fall into Mistakes and Over in all sorts of Calculations? Nay, I appe the Libeller, if his own Conscience does no him that he finds it so himself in his daily Pra

It is likewise true ( as the Libeller observes Pag. 32 ) that the Doctor did only consider the absolute Force of the Muscles which compress the Stomach. But since that is so great, as to exceed the Pressure that wou'd arise from the weight of 91 large siz'd Millstones, nay of near the double of that Number ; ( For it must be acknowledg'd, there is indeed a greater Oversight in this matter than the Libeller was aware of, the Doctor having taken into the Account the Muscles only of the one side of the Abdomen, intirely forgetting those of the other: ) I say, since the absolute Force of these Muscles is so prodigiously great, there is Room enough for large Deductions, upon the account of the Obliquity and Contrariety of their Actions, so as to leave sufficient Force behind for the Attrition of the Aliment. And the Doctor, satisfy'd with the general View of that vast Power, did not attempt to make an Estimate of the particular Deductions to be allow'd upon the mention'd accounts, as a Task next to impossible. The Libeller may try his hand upon it if he pleases.

As to the Numbers which regard the Breast, from what is left sound and unmangl'd in that Paragraph, 'tis easy to see the faults are plainly Typographical. The Paragraph is Pag. 57 of the *Dissertations*: *Pectus hominis est sphaeroid, cujus diametrus minor sit plerumque in majoribus digitorum quindecim. Ostensum est ab aliis, dilatato pectore axem minorem augeri, majori interim non diminuto, adeoque cavitatem amplitudinemque pectoris majorem evadere. Sit augmentum diametri a spina dorsi ad sternum pertingentis centesima pars digiti,*  
erisque

eritque augmentum cavitatis pectoris digitorum cubicorum 31 : tantumque aeris accipere potest accipietque pectus eousque dilatatum, ut ejus diameter minor aucta fuerit centesima digiti unius. Similiter si diametri minoris augmentum sit digiti quinquagesima, haurientur aeris digiti cubici 62. At si augmentum diametri sit quingentesima pars digiti, erit augmentum cavitatis thoracica digitorum sex : & si fiat augmentum tantum millesima pars digiti, cavitatis augebitur digitis tribus : tantumque aeris ad explicandos pulmones haurietur, adeoque tantillum explicari poterunt. Unde patet posse aliquam respirationem institui, licet augmentum diametri pectoris sit admodum exile, motusque vix visibilis.

Let the Candid Reader consider the Paragraph, and judge whether the Libeller had Reason for that impertinent Question *Pag. 27*, 'How come you to determine the Increase of the Cavity, by having only one of the Diameters of the Spheroid and its Increase? What *Archimedes* taught you this? &c. I'm wearied with his reviling and foul Language, and shall only gravely tell him, An honest Man wou'd have presently concluded, the other Diameter was omitted by the Printer. For since there were definite Numbers assign'd for the Augmentations of the Cavity, it was plain, they had been computed from two definite Diameters, and definite Augmentations of the one, without which given it was impossible for any created Being; why should I say impossible for any created Being? It was a manifest Repugnancy and Contradiction to the nature of Things, to have brought out any definite Numbers, true or false, for the augmentati-

tations of the Cavity. The omitted greater Diameter was 20 Inches, which with the Augmentations of the Cavity 31, 62, 6 and 3 Inches, standing as assign'd by the Doctor, plainly shew that the numbers expressing the suppos'd Augmentation of the lesser Diameter have been spoil'd by the Printer, and that the Paragraph shou'd be thus read. *Pectus hominis est Sphaeroidis, cujus diameter minor sit plerumque in majoribus digitorum quindecim, major vero diametrorum viginti. Ostensum est ab aliis, dilatato pectore axem minorem augeri, majori interim non diminuto, adeoque cavitatem amplitudinemque pectoris majorem evadere. Sit augmentum diametri a spina dorsi ad sternum pertinentis decima pars digiti, eritque augmentum cavitatis pectoris digitorum 31, tantumque aeris accipere potest accipietque pectus eousque dilatatum, ut ejus diameter minor aucta fuerit decima digiti unius. Similiter si diametri minoris augmentum sit digiti quinta, haurientur aeris digiti cubici 62. At si augmentum diametri sit quinquagesima pars digiti, erit augmentum cavitatis thoracica digitorum sex: Et si fiat augmentum tantum centesima pars digiti, cavitas augebitur digitis tribus. &c.*

But still the Libeller will insist upon his fetch'd Consequences, and contend it will hence follow, That, upon his Principle *Pag. 29.* of a Man's Length being commonly more than sexuple of the Cavity ('Tis the first time I have ever head Length compar'd to Cavity, but no doubt he means the Length of the Cavity) of the Thorax, I say, upon that Principle, he'll still plead it will follow, that the Man must be ten foot High: and from the measure of his Breast, that it must

be sufficient to hold ten Gallons of *English* Wine-measure. And no doubt it does follow. But what then? He'll tell me, that the Doctor has assum'd one, or both of his Diameters too big. Truly Mr. Libeller, if that will please you, I'm sure the Doctor will never refuse you the Concession. And I dare swear that in all this Matter there was nothing less in the Doctor's Thoughts than a Geometrical Determination of the Capacity of the Breast, as it really obtain'd in the humane Body, which was nothing to his Purpose: For his Business was quite another thing, *viz.* to shew, ' That ' the Capacity of the Breast might be so enlarg'd as to receive a quantity of Air sufficient to maintain a small Respiration, while ' the Augmentation of its Diameters were so ' inconsiderable, that the liftings and fallings of ' the Breast might escape the Observation of ' our Senses; Which he has as effectually done from the two Diameters of 15 and 20 Inches assum'd at Random for an Example, as if he had made use of the true Diameters taken by Rule and Compass from the humane Body. For 'tis a general Rule in similar Bodies ( as 'tis reasonable to believe the dilated Breast is to the Breast before Dilatation ) that their Capacities increase in the Triplicate Proportion of their Diameters or Homologous sides; And consequently the increase of the Capacity may be considerable, when that of the Diameters is not sensible. And the same Consideration may serve for an Answer to his Cavil about the Sphaeroidical Figure; For perhaps an Elliptical Conoid

Conoid comes nearer to the true Figure of the Breast: But the Doctor's Reasoning holds as well in the Conoid as in the Sphæroid, and any rude Approximation was enough to his Purpose, and he takes the Sphæroid as the more simple and better known Figure, and in that Sphæroid does not assert, but assume the Diameters to be 15 and 20 Inches, as his Words *Cujus diametrus minor sit, not est*, plainly imply. I believe in large siz'd Men these Diameters are rather generally about 8 and 12 Inches. In which Case the Man's height, by the Libeller's Rule, will be about 6 Foot, and the Capacity of the Breast ( consider'd as a Sphæroid ) will be about 14 *English* Pints, which is no exorbitant measure: And supposing each of these Diameters to be increas'd but by one fiftieth Part of an Inch, the Cavity will be enlarg'd by 3 Cubical Inches, which is a pretty large Allowance for a small Respiration, when the rising or subsiding of the Breast but to one fiftieth part of an Inch cannot be perceiv'd by our Senses. And thus, for all the Noise that was made, not one Proposition of the Doctor's is overturn'd, nor one flaw found in any part of his Reasoning. And while that stood unshaken, what a shame was it to fall a nibbling and catching at a few misprinted Numbers! That was a Play for Children, and not an Employment for a Man of Sense and Character. And when he has shew'd so keen a good Will to wound the Doctor's Reputation, and yet was able to say nothing, but such trifles, I think he has left the Doctor's as safe as he found it, and only injur'd, I shou'd rather have said, done Justice upon his own. But



But the Doctor must not be suffer'd to go till the Libeller gives him the parting Blow, and 'tis hard to tell, whether it shou'd provoke more our Indignation or our Pity, to see one who knows nothing at all of the Practice of Physick, in a matter of Practice so impudently attack one of the best Practitioners that's this Day in the World; one, who from a Rational and Demonstrative Theory has establish'd a no less Rational and Demonstrative Practice, one who from his happy Success has gain'd to himself a Reputation that is not to be shaken; whom the Sick cannot want, the wiser Physicians study to follow, and none envy but the Ignorant and Unskilful. This Charge is against that excellent *Dissertation, De curatione Februm quæ per evacuationes instituitur*, which he tells us *Pag. 34*, is the only practical *Dissertation* in all the Doctor's Works: As if the rest, tho' of a more speculative Nature had no Influence upon Practice. If he had understood Physick better, he had judg'd after another manner.

At first outsetting, he tells us *Pag. 34*, we must have Patience till we hear of your acquaintance with Steno, and a touch at your own Praise. I shall transcribe the Sentence from the Doctor's own *Dissertations, Pag. 121 §. 4.* that the Reader may judge whether there was Ground for that invidious Insinuation. It is this; *Nos autem Dissertatione de Circuitu sanguinis per vasa minima, quamvis fermenta hæc in corpore animalis ostenderimus non inveniri, tamen ut eorum capui consulatur, qui demonstrationem non capiunt, libet rem omnem vel tyronibus intelligendum dare. Ex iis,*  
*qua*

*que verbis Stenonianis hic descripta sunt, liquet quari,*  
 &c. Is there any Vanity, any Immodesty or  
 Ostentation in these Words? Or any thing  
 like the saucy dogmatick Air, which the Libel-  
 ler so often puts on upon far less occasion?

In the same Paragraph and the following, he  
 proceeds to give an Account of the greater Pro-  
 bability which the Doctor alledges for the going  
 off of Fevers by Secretion at the Skin, than any  
 other Secretion, which tho' he endeavours to  
 Represent in a ridiculous way with a Q. E. D.  
 subjoin'd to the tail of it, is still good Sense,  
 and as sound Practice.

The Affair is plainly thus; That after Blood-  
 letting and Vomiting in the Case of a Fever,  
 the Doctor sayes, 'tis more probable the Crise  
 must happen, and that it is therefore a more  
 reasonable Practice, to promote the Secretion by  
 the Skin, than any other Secretion.

That the Doctor presupposes Blood-letting  
 and Vomiting is evident from *Pag. 119.* where  
 he sayes, *Nos de Coctione illa tantopere celebrata  
 non disputamus, sed solum inquirimus, quanam evacu-  
 atio vel secretio deberet eligi, si ulla foret eligenda.  
 In hac investigatione prorsus silabimus de curatione  
 qua instituitur per sanguinis missionem, quoniam de-  
 crevimus eas tantum evacuationes inspicere, quae per  
 vias naturaliter patulas in animali sano emergunt,  
 quasque medici moliantur post celebratam vena sectio-  
 nem, vomituque pectus purgatum, si opus est, opus  
 autem est sapissime.*

After these Operations are over, he observes  
 first, That the Solutions of Fevers are carry'd  
 on by Secretion at the Skin by the Glands of the  
 Kidneys,

**Kidneys**, and by a Diarrhœa. His words are *Pag. 123, § 6.* *Observatum esse diximus solvi febres autâ secretione cuticulari, aliquando uero autâ secretione per glandulas renales, vel inducâ Diarrhœa, per hepatis, pancreatis aut intestinorum glandulas. De aliis Criseos generibus non opus est loqui, nisi forte quis icterum febri aliquando superveniensem superioribus velit adungere.*

Secondly, He observes that there is no matter of Secretion, but what may be carry'd off by any Glands of the Body, ev'n by such as are principally destin'd for other Secretions, which he proves to excellent good purpose in the few following words of the same *Pag. 123, Deinde observamus nulla esse vasa secernentia, nullasque in corpore nostro secretioni inservientes glandulas, quæ non possunt augeri intantam amplitudinem, ut pares sint accipiendæ secernendoque cuivis humori etiam in aliis glandulis secerni naturaliter apto. Quippe animadvertimus in ictero liquorem illum crassum, qui naturaliter secernitur in glandulis hepatis secerni in cuticularibus, & nimium saliva per suas glandulas proventum cohiberi sudore evocato, & liquore salivali eliminato per glandulas cuticulares: videmus diarrhœam sedari avarso humore in vias transpirationis sudorifica vi apertas, & pyralismo excitato citari alvum, excitata vero cursus diarrhœa cessare pyralismum, qui etiam, veluti alia secretiones, tollitur urina accedente profusio. And, as he proceeds § 7, In febribus præsertim observare licuit, quam sæpe quivis liquor per quavis vias ducatur artis aut nature vi dilatatas, quamque nulla sit febris cui similis soluta non fuerit. oborta secretionem per glandulas sudoriferas, sapius quam ulla alia secretionem: adeoque nullum esse genus materia febrificæ,*  
quod

*quod non possit duci per glandulas transpirationi dicatas, &c.*

And therefore the Libeller was egregiously in the wrong, when he tells us *Pag. 35* ‘ Before we proceed, I must tell you, that your second Observation is very ill supported by the Particulars you alledge in its favour, tho’ it serves you to no great purpose at present, if it were really true. For the Observation spoke of could by nothing be better supported than the adduc’d Considerations, and nothing could be more pat to the purpose intended. As to what he subjoins in the same Paragraph; ‘ Moreover, your Expression about Secretion shews how little you know of that Affair; but as this has been done already at greater length, I shall only observe how widely you differ from Dr. Cockburn on this Subject; yet he must needs be oblig’d to you for his Doctrine. Read him again, and you’ll find your changing Hands of Secretions very absurd; as also that your Circular Ducts of different Diameters help us very little in the case of different Secretions. I don’t know what possibly he can mean by the Doctor’s *changing hands of Secretions*; For the Doctor has said nothing here upon that Subject in the least differing from the Account he had given of that matter before in his *Dissertation, De circulatione sanguinis per vasa minima*; About which I need add nothing here to the ample Defence I have already made: And where Dr. Cockburn differs from him, it is such Stuff as is not worthy to be consider’d.

Lastly, The Doctor finds by Computat that the Secretion by the Skin is no less than double or triple of all the other Secretions together, and more than decuple of that by Skin alone.

From all which he concludes, That as the suppression of the one half or third part of the Secretion by the Skin may generate a Fever equal to that which the Suppression of all the other Secretions together would produce; And as the diminution of the Secretion by the Skin, to but a tenth part, wou'd bring on a Fever no less than what should be occasion'd from a total Suppression of the Belly: So the Augmentation of Secretion by the Skin will be of as great Benefit in carrying off a Fever, as the double or triple Augmentation of all the other Secretions together, and the increas'd Secretion by the Skin will be of no less moment, than the Secretion of the Belly alone augmented to a decuple Proportion. And was there ever a more rational and natural Conclusion? And could one have been the Libeller so weak, as to think he could overturn'd it by the naughty Account he pleas'd to give of it?

' But to leave this, ( says he *Pag.* 35 ) let us advance with you in your further Disquisition in the subject of Fevers: The next Enquiry then is, how much, and in what manner the Blood is chang'd or alter'd in time of a Fever. In order to resolve this useful Question, I have made Experiments, you say, may be proper, to shew the nature of the Fever-matter that passes, as may pass by any Vessel. But,

‘ more, these Experiments are really so proper  
 ‘ and material, that you think fit to put off the  
 ‘ Disquisition at this time; especially that you  
 ‘ seem to be of Opinion, that it may be fully  
 ‘ satisfy’d by shewing what Proportion the na-  
 ‘ tural Secretions have to one another. Howso-  
 ‘ ever improbable this Medium seems to be, yet  
 ‘ we are willing to learn, how, by the given  
 ‘ Proportion of Natural Secretion, the Disposi-  
 ‘ tion and Aptitude the Fever-Matter may have  
 ‘ to pass indifferently by any of the Secreting  
 ‘ Vessels. But in stead of the Demonstration,  
 ‘ all this Account is turn’d into a pitiful Com-  
 ‘ parison of *Sanctorius’s* Experiences, by the help  
 ‘ of a little Arithmetick; tho’ *Huygens* must  
 ‘ be brought into the Scene upon account of  
 ‘ the Chance that this Fever-Matter may have  
 ‘ to pass rather by the Skin, than at any other pass-  
 ‘ age of Evacuation. Had it not been more proper,  
 ‘ first to have answer’d your Question, and to have  
 ‘ told us the nature of the Fever-Matter; then your  
 ‘ Arithmetick might have found a place to shew  
 ‘ us the odds of this matter being voided at the  
 ‘ Skin, and at other parts? But your new  
 ‘ method of Demonstration is to beg the Questi-  
 ‘ on, and to fall foul on your Adversaries. On  
 ‘ the other hand, if you’ll allow a little of your  
 ‘ liberty to Dr. *Brown*, one Supposition for him  
 ‘ will conclude all you have said more powerfull-  
 ‘ ly against you, than your many Suppositions  
 ‘ make for you. Suppose then this Fever-Matter  
 ‘ or Ferment is in a very inconsiderable quantity  
 ‘ in the Blood, it will thence follow, that it may  
 ‘ be soon discharg’d by Stool or otherwise; and  
 ‘ far more certainly that way, than by the

‘ Skin; the means for producing that Effect being more constant in their operation. This one Consideration of a greater Certainty at once determines the choice of any prudent Person.

Was there ever such Stuff heard of ! What more proper or material Experiments, wou’d he have than these already adduc’d and above cited from the Doctor *Pag.* 123 of his *Dissertations* ( which for the Libeller’s sake I shall here repeat in *English* ) shewing, ‘ That the Bile, ‘ one of the thickest Fluids in the Body, which ‘ is naturally secern’d by the Glands of the ‘ Liver, yet in the case of a Jaundice is carry’d ‘ off through the dilated Glands of the Skin; ‘ That the natural Secretion of the Spittle is ‘ lessen’d by raising Sweat, and deriving part ‘ of it through the Cuticular Glands; That a ‘ Diarrhœa is abated by diverting the Humors ‘ into the ways of Perspiration enlarg’d by ‘ Sudorificks; That a *Flux de Bouche* hinders ‘ Excretion by the Belly, as the Excretion by ‘ the Belly stops or diminishes the Flux at the ‘ Mouth, which also, as well as all the other Secretions are lessen’d by a more than ordinary Evacuation of Urine. If these Observations don’t prove that all sorts of Secretions may be brought to pass through all Glands, I know nothing can. And being so, the Doctor’s Computation makes it plain, the chance for passing by the Skin is no less than Decuple of the hazard for passing by the Belly. The Doctor was blam’d for the looseness of his Numbers before, and ’tis hard he shou’d be now challeng’d for the Accuracy of them.

What

What the Libeller talks of the nature of the *Fever-Matter* or *Ferment* is such Stuff as shews he knows no more about the nature of a Fever, than he does of the Animal OEconomy. Doctor *Pitcairn*, in Compliance with the way of speaking of those whom he refutes, makes use indeed of the word *Materia Febrifica* or *Fever-matter*, but plainly insinuates there's no such thing ; and that Fevers proceed from Obstructions or Dilatations of the Glands, that is, from the Diminution or Augmentation of the Secretions carry'd off by the Glands above the natural Proportion observ'd in Animals of sound Health, as the learn'd Dr. *Cheyn* has shew'd more at large. The Supposition he makes for Dr. *Brown*, That his inconsiderable  
 ' Quantity of *Fever-matter* or *Ferment* may be  
 ' soon discharg'd by Stool or otherwise, and far  
 ' more certainly that way, than by the Skin, the  
 ' Means for producing that effect being more  
 ' constant in their Operations ; Is altogether  
 silly and ridiculous : For we can easily suffer  
 our Perspiration to be augmented to the decuple of its ordinary Proportion, when 'tis impossible to stand out against an hundred fold Evacuation by the Belly. And Dr. *Pitcairn* has demonstrated the one is but equivalent to the other. What Stuff is it he talks about  
*Certainty and Constancy in producing Operations* ? Can we not as surely produce a strong Sweat as a strong Purge ? If he knows not, any Apothecary's Boy can inform him. And for all he has said, the Prudence of the Choice still lyes upon the Doctor's side.

'Tis



'Tis not worth the while to take notice of what the Libeller lastly objects, *Pag.* 38. from the Operations of *Lenitive Medicines*. For, from the View I have already given of the Animal Body, 'tis manifest the Inner Surface of all that Canal which reaches from the Mouth to the Anus is as much external to the Animal as the outer-Skin; And the washing or augmenting the Perspiration of the one, is much the same thing with the washing and augmenting the Perspiration of the other: And the concluding Quibble about *Lenient Medicines* and *Gentle Purgatives* in favour of Dr. Brown, is of a piece with the learn'd Criticism about the word *Densus* with which he began. And in a word, all that he has said about Fevers is so extremely silly and Childish, that I'm truly ashamed to have taken so much Notice of it.

And now, Sir, I'm afraid I have transgress'd upon your Patience, as well as wearied myself with an ungrateful Subject. If we are to have more Works of this nature, I wish the Author may write in *Latin*, and there will be little need of a Reply: For it may be presum'd, such as are learn'd in that Language may be able to judge for themselves. Or if he must rather do it in *English*, because he understands that Language better than the *Latin*, if he wou'd but forbear his *Billings-gate*, and learn to write in a more civil way, he shall be sure of as civil a Return. And for my good Friend Dr. Pitcairn, I wish he may hasten the new Edition of his *Dissertations*, which is so much long'd for by the Learn'd both at home and  
abroad

abroad. And I do assure him, their own Merit will preserve them a lasting Book to after Ages, when the Libeller's Paper shall be quickly spent upon its proper Uses, which for decency's sake I forbear to name.

I am,

SIR, &c.

# ERRATA:

*Pag. 17. Lin. 1. Lege. YR. RZ. l. 3. Lege*  
*YRZD and so l. 6. L. 9. Lege FΠH p. 34 l. 11*  
*dele two. p. 41. l. 33. dele not.*

A Translation of the 83, 84, 85, & 86 Pages of Dr. Pitcairn's Dissertation, *De legibus Historiæ naturalis*, Printed at *Edinburgh*, Anno 1696.

**I**N the Year 1695, *William Cockburn* published his *OEconomia Animalis*, in which there is nothing at all that's new, but what he hath taken either from *Laur. Bellini*, or from me: Tho he hath not the Manners to mention either of us in his whole Book. All that he writes to the 17 Page, on *Chylification*, is mine; save only that he hath intermix'd these common Things concerning the Action of the Teeth, and the use of the Spittle: Not adverting, that I had purposely past over these, my Design being only to treat of the Motion by which the Meat is reduc'd to a liquid form in the Stomach, or of the Action of the Stomach, as I name it in the 2d Paragraph of that Dissertation.

But *Cockburn's* 39 and 40 Pages contain nothing but what is stoln out of the 66 Pag. of *Bellini's* Book, *De Urinis, pulsibus*, &c. of the *Francford* Edition 1685. The 41 Pag. is taken out of *Bellini's* Preface to that Work. The 42, 43 and 44 are copied from the

the 112 of the same Book, and the 45 from the 67. The 46 answers to the 72 and 69 of *Bellini*. Again the 47 is excerpted from the 73, and the 48 from the 74 and 73 of the same Author; and the 49 is mostly from the 65 *Pag.* For he jumbles and confounds them together after an odd manner. The rest of the 49 is intirely copied from what I dictated to my Scholars, without so much as the change of a Syllable. The 50 *Pag.* is wholly taken out of the 74 *Pag.* of *Bellini's* Book. What he has of the Temperaments is mine. For he hath faithfully transcrib'd my Dictates. The 55 and 56 *Pages* are from the 1, 2 and 3 of that Book *De Urinis*, and that so faithfully, that not so much as the Marginal Notes could escape being brought into his Book. The 57 is carefully stolen from the 7 of *Bellini's*, *De Urinis*. The 58 is intirely out of the 7 and 8, as are also the 59 and 60. *Bellini's* 12 *Pag.* hath furnish'd this Plagiary with his 61 and 62 *Pages*. He might with the same Confidence have borrow'd his 63, 64, 65, 66, and 67 from the same Book of *Bellini*: But he chose rather to express them in my Words, as I explain'd *Bellini's* Thoughts to my Scholars: For what Reason I know not,

not, if it were not that he thought that a Thief shou'd often change his Quarters.

At last in his 68, 69, and 70 Pages, he falls about the Solution of a Problem by his own Strength & For, alace, *Bellini* was now far away, having written nothing of that Matter ; And so *Cockburn* pitifully Blunder'd, tho otherwise the Problem may be very easily solv'd.

His 73 Pag. is patch'd up out of my *Dissertation, de Circulatione sanguinis in animalibus genitis & non genitis*, Printed at *Leyden* Anno 1693. His 82 Page also, wherein he magnificently explains the use of the Spleen, has nothing in it, but what is in the second Corollary annex'd to that *Dissertation* of mine. The same Corollary with the third following hath supply'd *Cockburn* with his 84 Page.

What follows concerning *Secretion* is wholly pillag'd from that Work of the great *Bellini* : All that he has upon *Respiration* is either taken out of *Bellini*, or my *Dissertation*, which I made to explain *Bellini's* Thoughts, and publish'd at *Leyden*, Anno 1693.

And that nothing of *Bellini* might escape his plundering Clutches, he publish'd a Book on *Sea Diseases*, wherein he

wou'd have the World believe that *Bell*  
Discoveries in the Matter of Fevers  
his own Inventions, And so by this time  
has almost wholly copied over *Bell*  
who yet after all is above the Reach  
his Comprehension.





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